



# **Towards design principles for project artistry in exploratory sandpit projects: A design-based research perspective**

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By

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**This thesis is dedicated to my late parents whom I lost during this PHD journey**

**Mamotseoa Ruth Molahlehi and Ts'olo Peter Molahlehi**

**Your beautiful spirits live forever.**



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To the Lord Jesus who has continued to guide, strengthen, empower, enlighten, infuse strength and hope in the darkest moments, thank you. This is for You.

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*Who is the Man, the Artist?  
He is the unspoiled core of everyman  
before he is choked  
By schooling, training, conditioning  
Until the artist shrivels up and is forgotten ...  
And yet that core is never killed completely.  
At times it responds  
To Nature, to beauty, to Life,  
Suddenly aware again  
Of being in the presence  
Of a Mystery that baffles understanding and  
Which only has to be glimpsed  
To renew our spirit and  
To make us feel that  
Life is a supreme gift."*

■ *Frederick Franck*

***Project Artistry-***  
*Bringing the artist back  
Into project management,  
Unleashing the potential within,  
Uncovering the hidden man,  
Reenergizing the artist within,  
Revitalizing the innate creativity of man  
And the collective intelligence of teams into play-  
Bringing the magic of creativity back to the world.*

■ *Puleng Makhoalibe*

## Abstract

Organisations are increasingly finding themselves operating in environments that are characterised by higher levels of ambiguity, uncertainty and complexity, as well as environmental and internal changes that are beyond their control (Reeves, 2015). This context is affecting the way in which projects are executed, as project managers are expected to conceive, manage and successfully implement projects within such an environment. An important question to ask is: Are intrinsically unpredictable environments becoming more dominant leading to increase in the complexity of projects? We are now living in a volatile, uncertain, complex and ambiguous (VUCA) world; project management as a field has to overcome significant barriers to change and develop the capacity for more subjective, interactive, and interpretive innovations that appear to be more effective in these settings.

The primary question addressed in this study is how the design of exploration projects may be carried out to bring clarity to project objectives and enablers. Design thinking, which is said to embody practices, mind-sets and processes that empower teams to co-create innovative solutions to wicked problems (Rittel and Webber, 1973) has been adopted in this study. Its design principles together with the creative problem-solving principles are combined to create a framework that facilitates design of exploration projects.

This study uses design-based research (DBR) to apply the emerging framework to educational sandpit projects. These projects inherit the characteristics of exploration projects which are highly ambiguous toward more innovative, context-relevant, targeted solutions developed by diverse project teams. The study adopted a qualitative, interpretivist approach in order to enhance the design principles emerging from this study through authentic interventions in educational sandpits using DBR as a methodology.

The outcome of the study, namely, a project artistry framework, emerged from the iterative process which was undertaken. The framework's value proposition is that it (the framework) had

been proven to enable diverse teams to shift the participants' orientation from significant ambiguity and uncertainty to the ability to plan action by co-creating project visions with clear objectives and goals.

The project artistry framework reflects the construction of a house and a more holistic framework, which consists of a roof (design process), the pillars required to hold up the roof (design pillars) and the foundational bricks. The design pillars include reflection, creative language, applied imagination, diverging and converging while the foundational bricks include empathy, empowerment, engagement, emergence, experimentation, environment, exploration and exploitation. In addition, an ambiguity acceptance journey is proposed to encourage a tolerance of ambiguity that leads to questioning and inquiry in projects that cultivates fresh insights and innovation in projects.

New approaches to project leadership and design are essential to transform the world we live in. Although no panacea, project artistry provides project leaders with a new dimension to understanding the changing conditions that surround their project and envisioning better, innovative solutions to some of the most troublesome challenges facing our projects. It brings together the power of analysis and intuition to synthesize real solutions that not only work but meet the needs of the people. This fresh approach also brings enlightenment and transformation to those engaged in such projects and cultivates creative confidence and fosters collaboration.

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## List of acronyms / abbreviations

The following table describes the significance of various abbreviations and acronyms used throughout the thesis. The page on which each one is defined or first used is also given. Nonstandard acronyms that are used in some places to abbreviate the names of certain white matter structures are not in this list.

Abbreviation	Meaning
<b>ASLP</b>	African Science Leadership Programme
<b>CPS</b>	Creative Problem Solving
<b>DBR</b>	Design Based Research
<b>ETILAB</b>	Educational Technology Inquiry Lab
<b>IT</b>	Information Technology
<b>PMBOK</b>	Project Management of Knowledge
<b>PM</b>	Project Management

## Publications and presentations relevant to this thesis

### Books by Puleng Makhoalibe

1. The Alchemy of Design Thinking.  
Author: Puleng Makhoalibe  
2016  
ISBN: 978-0-620-71560-7
2. The Alchemy of Disruptive Intelligence  
Author: Puleng Makhoalibe  
2017  
ISBN: 978-0-620-75013-1

### Papers published in journals and conferences:

1. Makhoalibe, P. & Ngambi, D. (2014). Design thinking as a catalyst for a culture of innovation in organisations: a case of project management. *South African Innovation Summit*, 2(1), 95–110.
2. Makhoalibe, P., & Sewchurran, K. (2012). Applying creative project management: A study of ICT projects in humanities faculty in South Africa. *INTED2012 Proceedings*, 3256-3265.

## Chapter 1: Introduction

### Overview of chapter 1

Chapter 1 of this study presents an overview of the research problem, the purpose of the study, research objectives, research questions and the process followed to carry out this research. The importance of the study and the context in which it was conducted are explained and, lastly, to conclude, the conceptual model – a graphical depiction of the roadmap of the thesis – is shown to explain the entire journey undertaken by the researcher.

### 1.1 Motivation for the study

At the Project Management Institute Research and Education Conference held in Portland, Oregon in the United States of America in 2014, the organisers conducted a World Café event to conclude the conference. This World Café provided practitioners, researchers and educators with the opportunity to reflect on and discuss trends in the project management field. Fourteen future trends for project management research emerged, including the following two trends which were relevant to this thesis:

- The project management paradigm misfit for certain “projects”
- Diffusion of innovation in project management

*(World Café – Project Management 2015: Trends in and Direction for Academic Research and Practice, 2014).*

The above trends were further reinforced by the closing keynote speaker, Dr Anne Huff, with a presentation entitled “Useful tension for project managers” at the conference. She suggested that it is essential that organisations develop new mind-sets to find new ways of working as the existing, embedded practices obscure and overlook strategically critical innovations. Such provocative



thoughts from leading experts in the field of project management formed the basis of this thesis.

The project management body of knowledge (PMBOK®) has been in existence for decades and is continuing to grow, develop and improve through substantive research. In addition, there is also evidence of exponential growth in project management certification which shows that, increasingly, practitioners are enrolling in programmes that enhance and empower their project management skills. Nevertheless, there is as yet little evidence to prove that there is a matching improvement in the execution of projects in practice. In fact, there is a marked lack of alignment between the growing body of knowledge and the as-lived project experiences (Sewchurran & Scott, 2009).

The Standish group, formed in 1994, conducts studies on the success of information technology project and publishes reports, known as chaos reports, which are intended to expose the chaotic nature of information technology projects. The first study indicated that, on average, 16% only of IT projects were considered to have been successful. Several repeat studies have since been conducted. Twenty years later, the 2014 Standish Group research showed a staggering 31.1% of information technology (IT) projects would be cancelled before they were ever completed. Further results indicate that 52.7% of projects will cost 189% of their original estimates (Clancy, 2014). These statistics show that, despite ongoing research and publications, there has not been a matching improvement in the success of information technology projects. Nelson (2007) found similar statistics in a study of 99 projects in North America and says while the accuracy of these statistics may be debated and presented in more stratified ways, the wider concern about the state of knowledge of the discipline remains valid for the project phenomenon while espoused theories of managing projects are conspicuous.

The relevant and persisting problem with the project management body of knowledge is the ongoing emphasis on command and control as this represents a mechanistic and linear approach to project management (Sewchurran, 2008). In his paper in which he reconstructed the project management body of knowledge, Morris (2013) observed that the aim of the PMBOK® Guide had never been to cover all the knowledge required to manage projects as is typical of the majority of professional

disciplines' bodies of knowledge. This sentiment is shared by other writers on the subject who also focused on rethinking project management such as Smith & Winter (2010).

Morris maintains that this approach encourages a fragmented approach to project execution and which tends to result in rote application, job fragmentation and bureaucratic control while also diminishing the role of the judgement, innovation and coping which is needed to apply knowledge in different contexts (Morris, 2013). The ethos of the Project Management Body of Knowledge (PMBOK) project management process does not accord recognition to the contingent and situated nature of the project execution process that prevails in practice (Hodgson & Cicmil, 2006). The following are relevant and ongoing problems in the project management field.

Firstly, there have been numerous debates on the issue of bridging the gap between theory and practice with suggestions being made regarding more practice-led research and theory-led practice than are currently the case. However, Bredillet (2013) suggested praxeology as a method of enquiry in project management as this would always result in both praxis and more practice-led theory. Nevertheless, the dichotomy between the eloquence of the theory and its lack of impact on practice remains a key issue. The researchers who theorise about project management tend to lack applicability while those who practise project management often lack platforms for theorising and influencing the project management body of knowledge. This discourse is observed throughout the project management body of knowledge and remains a key issue.

Secondly, the one size-fits-all approach to projects does not do justice to the dynamic contexts, environments, industries and nature of project types. Moreover, projects are managed by human beings and are executed by humans. This adds complexity to the issue while the emphasis on the mechanistic tools and rigid processes does not empower project managers in the various settings to deal with the complexity inherent in human activity systems. On the contrary, it hinders the innovation and affordances required to deal with the 'emergence' inherent in projects run in volatile environments and characterised by high levels of uncertainty. Project management tools and techniques are based on a deterministic and reductionist approach, which is in turn based on the

linear cause-and-effect thinking that forms the basis of the traditional management concepts and scientific principles of management that emanated during the 19th century after the Industrial Revolution. In a mechanistic way, the scope of the project is determined and broken down into the work breakdown structure, which constitutes the core of project management techniques. However, the challenge that remains is the way in which the scope is broken down when there is both ambiguity and uncertainty and the stakeholders do not even know what they want.

Thirdly, a number of studies have investigated the value of project management tools, such as Gantt charts and work breakdown structures, as regards either their contribution to project success or their usefulness to the practitioner (Besner & Hobbs, 2006). The outcomes of these studies have alluded to the inadequacy of these tools in practice where complexity and ambiguity are realities in the projects concerned. For example, White and Fortune (2002) highlighted that these tools are frequently inadequate as regards complex projects or they are difficult to apply in the real world. Crawford (2005), in reflecting on the lack of empirical evidence on project management standards and workplace performance, further suggests “that the knowledge and practices valued by project management practitioners, and embodied in their professional standards, are not the same as the knowledge and practices valued by senior managers”. Winter (2006) further notes that it is not these tools or particular products that deliver projects, but rather people and hence the emphasis should be on the people rather than on tools. There are still ongoing debates on the construct of project management as well as on whether project management is an art or a science or both (Briggs, 2012).

Lastly, the project management literature recognises the complexity of both project management and project environments and acknowledges the limitations of the traditional project management approach and tools (Soderhold & Lenfle, 2013). Nevertheless, there has been limited innovation in project management as regards devising a new approach and new tools. Some of the approaches, such as the agile and scrum approach, have afforded a level of flexibility as well as the ability to deal with the fast-changing project environment although they have been criticised as representing just an extension of the existing approaches and tools that provide only more of the same results (Duggal, 2010). What is, in fact, needed is brand-new approach to project management rather than just

planning complex projects. Some writers have suggested new design approaches that may result in new mind-sets and tools in the project management body of knowledge (Duggal, 2012; Obeng & Christophe, 2008). Researchers believe that, in order to overcome the challenges inherent in managing projects, fresh approaches to practitioner development are needed (Atkinson, 2008; Córdoba & Piki, 2012; Egginton, 2012).

The next section discusses the fundamental principles of project management relevant to this thesis.

## 1.2 Fundamental project management principles relevant to this thesis

### 1.2.1 Project classification school of thought

Firstly, I wish to build on the work on project classification in terms of which a distinction is made between the various types of design situations to which different projects types are suited (Aucoin, 2007; Lenfle, 2008a; Obeng & Christophe, 2008; Turner & Cochrane, 1993). This study focused on the management of projects where it is not possible to define either the goals or the means to attain these goals at the beginning of the project. There are various names given to such projects, for example, 'type 4 research and development projects' (Turner & Cochrane, 1993), 'foggy projects' (Obeng, 2003), 'stretch projects' (Aucoin, 2007), 'projects with high levels of uncertainty' (Winter & Szczepanek, 2009), 'dance projects' (Duggal, 2010) and 'exploratory projects' (Lenfle, 2014). Although the naming of these projects by various writers is not consistent, the definition of these projects is consistently underpinned by the level of ambiguity. Each study highlights the lack of literature regarding the project management body of knowledge required to equip project managers to deal with projects, which are defined by high levels of uncertainty. In the context of this thesis, such projects will, in accordance with Maniak, Midler, Lenfle & Pellec-Dairon (2014), be termed *exploration projects*.

This term was deemed to be plausible, self-explanatory and consistent with the latest research. Recent research has demonstrated that exploration projects are strategic in the innovation-based competition of today's world (Lenfle, 2014; Loch, 2006). The landmark contribution of Loch (2006) underlined the

need to invent new ways in which to manage exploration projects and demonstrated the irrelevance of traditional risk management techniques in projects confronted by what may be termed unforeseeable uncertainties (Lenfle, 2008b). Nevertheless, a practice perspective that may further the understanding of the organisation and management of such projects is still lacking (Lenfle, 2014).

It is the aim of this study to contribute to the project management body of knowledge in the context of the specific projects, which are referred to in the study as *exploration projects*.

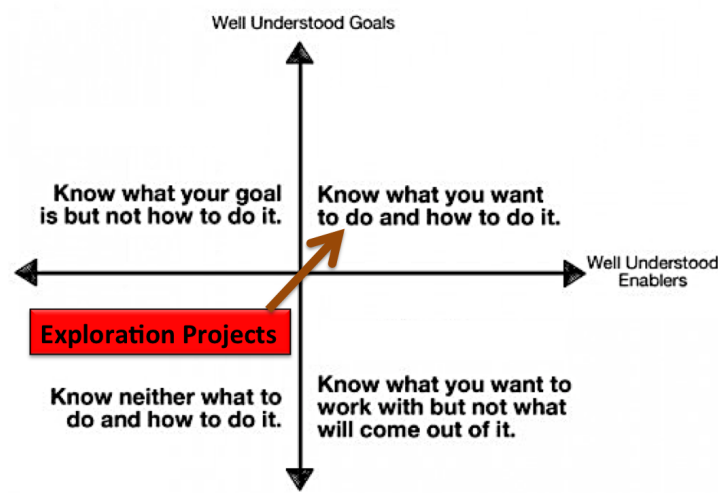


Figure 1: Project classification and graphical depiction of the intention of this study

Figure 1 presents a graphical depiction of the four types of projects referred to in scholarship, defined by the ambiguity of the goals and enablers. The arrow in the figure from exploration to the quadrant with well-understood objectives and enablers demonstrates the purpose of this study as regards bringing clarity to and enhancing the existing understanding of exploration projects. The following three areas are explored as regards bringing clarity to exploration projects, namely, the organisation of exploration projects, the creativity of the project team members and ambidexterity in the management of exploration projects. These areas are explored in the detailed literature review in Chapter 2.

### 1.2.2 Management of exploration projects

There is evidence that the existing project management body of knowledge does not sufficiently equip project managers with the tools required to deliver projects successfully in the twenty-first century. As a result of the volatile operational environment, projects are characterised by high levels of uncertainty and are increasingly becoming multidisciplinary in nature. This impacts on the role of the project manager who is now charged with bringing synchronicity and a holistic approach to projects. There are ongoing debates about the need for leadership or management in projects. A study conducted by Mir and Ashly (2014) showed a statistically significant positive relationship between project leadership and project success while a study by Ramazani and Jergeas (2015) showed that project management graduates require strong critical thinking and leadership competencies such as communication and team working skills but that, at present, it does not appear that they possess the necessary competency in these fields. The lack of the leadership component in project management constitutes an ongoing debate and is in fact resulting in an inability to deliver projects, especially in a complex, volatile environment.

### 1.2.3 Creativity in exploration projects

Leybourne and Sainter (2012) mention the following two views of project management:

- 1) The traditional view where the management of project-based activity is related to process and control, and
- 2) An emerging view that is more sympathetic to the need to resolve the uncertainty caused by environmental turbulence and changing requirements and which utilises creativity, intuition, and the tacit knowledge built up over time and through experience.

The latter view is emerging as a dominant view in the project management body of knowledge. It is believed that the traditional project management processes stifle creativity. According to Leybourne and Sainter (2012), the standardisation inherent in traditional project management may overly restrict the implementation of processes and limit creativity in problem solving.

Klein, Biesenthal, and Dehlin (2015) are of the opinion that improvisation is a process in which thinking is expressed through spontaneous and creative actions (Leybourne, 2009) and that perceiving improvisation as a sense-making activity in flux highlights the importance of creativity. They further refer to the nature of uncertainty in projects in that, if something is in the process of 'becoming', there is naturally a degree of uncertainty attached to it while uncertainty leads to the possibility that existing plans may not unfold as intended. Klein et al. (2014) further maintain that it is essential that project actions and practices adjust quickly and spontaneously and, thus, creativity is required.

Crawford, Pollack, and England (2006) maintain that complex project surroundings require a capacity for open creativity, trial and error and a context-sensitive transformation of old experiences into expert action in order to generate a resilient project management approach. This is particularly important in dynamic, uncertain, complex, transient and fast-changing industries and contexts. There are numerous with these characteristics (Geraldi, Lee-Kelley, & Kutsch, 2010) and thus these projects require an improvisational mind-set that fosters spontaneity, creativity and experimentation as well as the situational synchronisation of resources in the organisations concerned (Barrett, 2006). Creativity appears to be a vital component in the project management of highly dynamic, uncertain and complex projects, and yet there seems to be a minimal conceptualisation of creativity in project management, as well as how it could be systematically incorporated in project management to empower project managers, teams and stakeholders to harness the power of creativity.

#### 1.2.4 Ambidexterity in exploration projects

The Oxford English Dictionary online defines ambidexterity as the ability to use both the left and the right hand with equal ease. Organisational ambidexterity refers to "an organisation's ability to be efficient in its management of today's business and also adaptable for coping with tomorrow's changing demand" (Raisch, Birkinshaw, Probst, & Tushman, 2009). Thus, just as being ambidextrous refers to the ability to use both the left and right hand equally, organisational ambidexterity requires organisations to use both exploration and exploitation techniques to be successful. The use of the

word ambidexterity in scholarly debate has proliferated (Raisch et al.) in multiple areas of research, including strategic management, innovation and technology management, organisational learning, and organisational behaviour (Simsek, 2009). In essence, ambidexterity requires success both in exploiting the present and exploring the future (O'Reilly & Tushman, 2004).

Although ambidexterity is increasingly being discussed at the organisational level, it seems that there is little evidence of its emergence in the project management body of knowledge. In this thesis, I propose that this aspect is critical in the project management of exploration or innovative projects as the primary purposes of such projects are to serve future markets and to remain sustainable once launched.

There are writers such as Andriopoulos and Lewis (2009), Lavie and Rosenkopf (2006) and O'Reilly and Tushman (2004) who propose that structural ambidexterity may be managed through the project portfolio by initiating different projects for exploitation (e.g. incremental developments) and exploration (e.g. breakthrough innovations). Although this may be possible at an organisational level I suggest that building in ambidexterity in project management will inherently create a culture of innovation within project teams as they constantly seek both exploration and exploitation in their project work and this may impact on the organisational work at large.

### 1.2.5 Innovation in project management

Lastly, despite the fact that in the last few years the emerging project management literature appears to be starting to recognise the complexity of project management and project and to acknowledge the limitations of the traditional project management approach and tools (Lenfle, 2013), there has been limited innovation in project management regarding devising new approaches and new tools. Some of the approaches, such as the agile and scrum approach, have afforded a level of flexibility as well as the ability to deal with the fast-changing projects environment, although they have also been criticised as representing just an extension of existing approaches and only giving more of the same results (Duggal, 2014). What is in fact required is brand-new approaches and not just the planning of complex projects. Some writers have suggested that new design approaches may result in new mind-sets and



tools in the project management body of knowledge (Duggal, 2014).

### 1.2.6 Project practice as coping by learning and innovating

The project management definition of the Project Management Institute (PMI) and cited below creates the impression that project managers engage only in rational activities during the management of projects. According to the PMI, project management is:

*The application of knowledge, skills, tools and techniques to project activities to meet project requirements and is accomplished through the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling, and closing (PMI, 2004, p. 8).*

In an effort to explain the innovative nature of project work, as well as the deviation between the planned and actual work, there is a long tradition of research into the operational research discipline, which claims that decision makers face bounded rationality. Sadler-Smith and Leybourne (2006) and Söderholm (2008) discuss the use of improvisation and intuition to explain deviations from rational judgement. They point out that best practice prescriptions are devoid of any approaches to dealing with unexpected activities, for example, innovative action, applying detachment strategies, setting up intensive meeting schedules, and negotiating project conditions, despite the reality that such interventions are regularly required during project execution. Innovative action is explained by Söderholm (2008) as “the ability to deal with unanticipated changes like schedule conflicts and resource reallocation to cater for on-site short term problem solving”.

## 1.3 Proposition of the thesis:

In this research study, I wish to contribute to the ‘*lived experience*’ of project management literature by exploring how a different perspective on projects may bring about new insights into fundamental project concepts. This should diversify the current understanding of project management beyond the

knowledge emanating from positivist scientific research. This endeavour was driven by the suggestion that the positivist and Cartesian foundations that often underpin much of the existing traditional project management research and practice are not sufficient to improve project outcomes. Especially in the world in which we live and that is characterised by high uncertainty and complexity, the projects that have become more dominant in organisations are increasingly explorative and innovative in nature. It is posited that, enriching our understanding of exploration projects, including an understanding of the personal 'lived experience', will further the existing knowledge of these projects in practice. The new insights resulting from this improved understanding of existing literature as well as the 'lived experience' should help to improve the outcomes of exploration projects.

Using the five themes above that emerged from the study of the four dichotomies cited in the existing project management literature, I propose rethinking the main constructs of project management in the context of exploration projects. I also argue that the current underlying constructs hinder and threaten the successful implementation of exploration projects which are characterised by a high level of ambiguity and uncertainty. I suggest that there is need to rethink the planning, implementation and leadership of exploration projects.

This suggestion is in line with the work of Duggal (2012) who proposed project artistry as a way of managing dynamic, ambiguous, non-linear, complex and emergent (DANCE) projects. He suggested a greater focus on design than on planning and drew on the insights of complexity science and design thinking in order to provide a new perspective on complex projects. The aim of this thesis was to build on Duggal's work by designing a project artistry framework. This framework would be used in the leadership of exploration projects in order to create both a common vision and clarity and to allow rapid prototyping. This should enable dynamic teams to co-create, ideate, develop and test possible solutions within a short period of time. Project artistry is an emerging design school of thought that draws on design thinking and creative problem solving to facilitate creativity and original thinking in teams in their dealing with wicked problems.

## 1.4 Positionality of the researcher

This section discusses the researcher's background, experience and knowledge in the context of the study. I believe that, as the researcher, I played a crucial role in the qualitative research process and, thus, the reader should be made aware of all the prejudices and biases I may have brought with me to this study. I deemed it necessary to communicate possible sources of these biases explicitly to the readers of this research report.

### 1.4.1 Experience with project management

I embarked on this research journey as a result of the six roles I have played in project management in the past fifteen years. I have been a practitioner in the information technology industry for fifteen years and I have been a member of diverse project teams in industry, government and educational institutions. I also played different roles in these project teams as a developer; tester, analyst and consultant. My roles in these diverse spaces gave me experience of project teams and the complexity involved in the management of teams in project situations. I defined this as my first role in project management. The multidisciplinary nature of information technology projects and the critical role these projects play in executing organisational strategy have led me to become passionate about project management.

Secondly, for six years my primary role was software and web systems development, which involved executing given tasks within a given time frame and adhering strictly to the project plan. There was dependency on the use of the methodology known as the software development life cycle. Although agile methodologies were sometimes adopted, the continuous pressure from clients and initial plans and timelines tended to restrict the innovativeness of the results. While I was working in this high-pressured environment with strict timeliness, I also enrolled for an MBA. This exposed me to other creative problem-solving processes, which I found useful in managing and solving problems. I identified ways that these strategies could be integrated into the software development life cycle in order to improve efficiency and enable successful delivery. It was often a struggle to introduce these

concepts to organisations that were highly centralised, prescriptive, hierarchical, and resistant to change. The above further enforced the dichotomy between theory and practice and the fact that underlying, fundamental project management principles are not flexible enough to allow contextualisation to a particular environment.

I was appointed as an information technology manager of a university faculty. My key performance indicator was the project management of technology projects in the educational field. This was third role in project management as a practitioner with intense daily pressure to deliver complex projects successfully in real life situation.

My fourth role in project management was as a project management student in various settings in accredited and open programmes. I was perturbed by the prescriptive, straightforward, positivist teaching approach that suggested both that there is a simplistic definition of projects and their management and also that training on several project management tools and frameworks over a number of days, followed by an examination in some instances, empowered the individual to manage projects in real life. In addition, I found that many job advertisements for project managers require the applicant to be certified by project management bodies as a guarantee of the effective, successful management of projects in industry.

I experienced both discontentment and an internal struggle as I had realised that the tools and the frameworks, the project management courses and the certifications are not always a guarantee of successful project implementation in the real world. There is a, without doubt, a dichotomy between the project management body of knowledge and the as-lived project experiences. The complexities, uncertainty and vitality of the operational environment far exceed the simplicity inherent in the texts on and the theories of project management projects. The Standish group chaos reports<sup>1</sup> continually reported the failure of information systems projects despite the increased certification awards and enrolments in project management courses.

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<sup>1</sup> <https://www.projectsmart.co.uk/white-papers/chaos-report.pdf>

As a result of my curiosity about the subject matter, I enrolled for a PhD in project management in order to study the dichotomies in project management, understand the foundational principles of project management and attempt to bridge the gap between theory and practice and also to enquire how the project management body of knowledge could move away from the positivist paradigm that is misaligned with realities and become more relevant to and empowering for the practising project manager. Thus, this constituted my fifth hat role in project management, namely, that of a researcher engaging with and contributing to the project management body of knowledge.

My passion for the subject of project management and my desperation as regards a project management pedagogy that would be relevant, useful and empowering to practitioners led me to start lecturing in the subject – my sixth role of a lecturer in the project management field. The courses I lectured were aimed at postgraduate information systems practitioners who were studying part-time in order to equip themselves for work in industry. The design of the courses emerged from the work of Sewchurran et al. (2010) and demonstrated the bewilderment expressed by practitioners who reported the considerable mismatch between the prescribed practices into which they were trained and their actual experiences of project work and also suggested a regional ontology for information systems project management. The above endeavour culminated in a new project management course, which was aimed at bridging the theory-practice gap by equipping the students with the required project management tools and theories but also balancing this with the new paradigm thinking on project management and, thus, empowering them to deal with emergence of the intangible aspects of project management. I was privileged to use this platform, not only to lecture, but also to share other emerging project management phenomena such as projects as human activity systems, projects as complex adaptive systems, projects and sense-making, holistic views on projects through systems thinking, the role of creativity, the use of Edward Debono's (1999) six thinking hats in project situations and many other emerging concepts.

As a researcher, I also had the opportunity, on a yearly basis, to enquire from the students about the frustrations they experienced with project work in their organisations. Through these enquiries, I learnt that the project management field has a gap between theory and practice and that more work is

needed to bridge the gap by both theory-informed practice and practice-informed theory. In other words, what Bredillet (2013) terms praxeology, implying “instilling practice with theoretical content and theoretical formulation resulting from practice”.

#### 1.4.2 Experience with design thinking and creative problem solving

My first encounter with design thinking was through a creativity, strategy and design course, which I undertook during my Master in Business Administration at the University of Cape Town. Of all the strategic tools, frameworks and processes to which I was exposed, the non-conventional methods of engaging creativity and intuition in management appealed to me. As a software engineer at the time, the processes to which I was exposed were highly structured and rigid, while even the agile software development processes were restrictive and did not integrate a systematic way of embodying creativity, co-creation with users and empathetic approaches in the processes. I learned that, although it was empirical to engage whole brain approaches in every business process, most of the popular models engaged the logical brain only. The majority of business decisions are analytical while the reasoning that drives most industries is based purely on facts, analysis and logic. In addition, in the education system, this approach is highly advocated and most business courses are taught from this perspective.

However, this approach is contrary to the reality of businesses in the twenty first century as these businesses continuously face challenges and operate in a highly unpredictable, volatile and changing environment that cannot be sustained by the old ways of thinking that are based on analytical, positivist and prescriptive ways of thinking. Instead, the basis should be the holistic, whole brain, dynamic interplay of the analytical and intuitive reasoning that allows the exploitation of existing data but, at the same time, embraces the exploration of the unknown future. Writers such as Ken Robinson (2006), who refers to creativity as a critical twenty-first century leadership skill, and Daniel Pink (2006), who maintains that we are now living in a conceptual age and not in the information age which capitalised on knowledge economies, are of the opinion that we now live in an era in which whole picture capabilities, conceptual mind and creative approaches are essential for success.

My exposure to design thinking and creative problem solving that encouraged creativity and applied imagination in problem solving led me to challenge the way I think about project management methodologies. I explored new ways of integrating these educational technology projects, and they facilitated remarkable outcomes and new approaches to project work. This led to a publication in the International Journal of Technology and Education. The title of the paper is “The application of creative project management: A study of ICT projects in the Humanities faculties in South Africa” (Makhoalibe & Sewchurran, 2012). This formed the basis of my desire to study the integration of design thinking and creativity into project management, hence, this research undertaking.

### 1.5 Implications of the roles of the researcher

The six project management roles identified above and my experience of design thinking highlight my involvement in this area or study. I have intentionally made these explicit and revealed them at this stage to address the issues of subjectivity and interpretation, and to justify the research methodology and paradigm used in this study. I brought to the research, not only my experience resulting from the different project management perspectives, but also my passion and curiosity about this field. This may have had both a negative and a positive impact on the way in which the research was carried out and interpreted. It is, therefore, my intention in this section to disclose my subjectivities, biases and prejudices in order to be aware of these and, thus, to ensure that I conducted the study in a credible way that guaranteed that they did not influence either the outcome or credibility of the study. This was in line with what Gadamer (2004a) says about interpretation, namely, that “we may not be able to get rid of our biases, but can be better interpreters if we are aware of them”. It was, therefore, my intention to disclose my background, experiences and views about the research topic in advance.

I chose to conduct an exploratory research study. This required me to understand both the principles underlying the historical project management theories and the new paradigm thinking in project management and to allow the emergence of themes or constructs from the theory, which was the result of the findings of experts in the field and not my own subjective experience.

Some philosophers believe that it is possible for a researcher to adopt a neutral stance in a particular research activity. However, as much as this is ideal, such neutrality may also take away the voice of the researcher whose interest in the research activity influences the shape and the interpretation and, thus, the voice in a thesis. Accordingly, it is difficult for me to claim that I adopted a neutral stance and I preferred to communicate explicitly to the reader all the possible biases and prejudices that I may have brought to the study.

As the researcher, I played a crucial role in this qualitative research process, exploring the research topic, engaging with texts on the theory of project management, interpreting these texts and studying them, while carrying out project management in my work environment as a practitioner. Although I endeavoured to remain subjective while conducting this study, it must, however, be borne in mind that any researcher is only human. Accordingly, I attempted to disclose my own biases, preferences and assumptions as explicitly as possible when engaged in the research process and when articulating the process carried out in the study. In some instances, I used colour-coding to highlight my thoughts and perspectives that emerged during the research process. Reflexivity was key to ensuring an awareness on my part of my role in the research process and in carefully considering my actions and thoughts throughout the process. I managed to capture some of these actions and thoughts in this report<sup>2</sup>. In order to do so I used a purple textbox starting with ‘\*’ as demonstrated below.

*\* At this point, it feels awkward to make a claim regarding the integrity of this thesis. First disclosing all my experience and the roles I have played in the project management field, and then claiming that I had confronted my biases and prejudices and acknowledged them helped to remain more self-conscious than may otherwise have been the case as I mis/interpreted text. This is a difficult claim to make. It sounds vague and, yet it is important that the reader is also aware of it as they use their own lens to interpret what they are reading.*

As regards researcher skills, Yin (1989) suggests that a researcher should either develop or already possess the following skills when pursuing truths through research, namely, the ability to ask the right

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<sup>2</sup> Purple textbox starting with \* was used throughout the thesis to highlight interesting thoughts, surprises, biases and subjectivities on the part of the researcher.



questions and interpret the answers. It is no wonder that Morse (1994, p. 225) remarks that qualitative research is only as good as the researcher's;

- willingness to be flexible and the ability to read the situation; and
- distance to be unbiased.

In order to achieve this, the reader will note grey textboxes in the following chapters. A design-based research methodology was adopted (more information in Chapter 3) for the purposes of this study. This approach requires the researcher to work closely with the relevant practitioners and this demands that the researcher is willing to let go of his/her pre-judgements and perceptions and create the distance needed to ensure the researcher is unbiased. In order to facilitate this and to ensure that it was reflected in this thesis, the practitioners' reflections<sup>3</sup> and quotes are displayed in blue textboxes with '#' such as the textbox below.

*"#The education field is very complex. Education itself is complex and technology has its own complexities. Bringing these together introduces a higher level of complexity and yet technology is meant to simplify work in education". Practitioner*

I also noted the participants' comments<sup>4</sup> which supported themes which emerged from the empirical observations and transcriptions of the participants' comments. These are denoted in the thesis by means of orange textboxes starting with "".

❖ *"This has been a very empowering process that has changed my mind-set. I will never approach problem solving in the same way again." Participant*

These orange textboxes were used consistently throughout the paper and clearly demonstrated the various roles played by the participants in this study and their comments.

<sup>3</sup> Blue textbox starting with # used throughout the thesis to highlight the practitioners' comments

<sup>4</sup> Orange textbox used throughout the thesis to highlight the participants' comments.

## 1.6 The approach used in this study

*"To understand a rose, one person may use geometry and another the butterfly"*  
*Paul Claudel (1929).*

There were many ways in which this study could have been conducted. In order to choose the correct approach, it was important to unpack the research objectives and the current body of knowledge on the research topic. This is an exploration study on the way in which design thinking and creative problem solving may address the knowledge gap identified in the project management body of knowledge regarding managing projects characterised by high levels of uncertainty. This was tested by means of a case study which was carried out in the education field.

A qualitative interpretivist approach was adopted for the purposes of the study. The study was positioned in a post-positivist paradigm. The reasons for this decision are presented in Table 1 below, adapted from Weber (2004), which compares positivism and interpretivism. The last column reflects my own stance on this research study and justifies the adoption of interpretivism in the study.

Table 1: Positivism vs interpretivism

Metatheoretical assumptions	Positivism	Interpretivism	My (Researcher) stance
Ontology	Person (researcher) and reality are separate.	Person (researcher) and reality are inseparable (life-world).	I am inseparable from the reality of this thesis.
Epistemology	Objective reality exists beyond the human mind.	Knowledge of the world is intentionally constituted through a person's lived experience.	I believe knowledge is built through one's internal structure of interpretation based on one's culture, experiences, background etc.
Research object	Research object has inherent qualities that exist independently of the researcher	Research object is interpreted in light of meaning structure of the person's (researcher's) lived experience.	Sense-making activity is affected by and affects one's life experiences.
Method	Statistics, content analysis	Hermeneutics, phenomenology, etc	Hermeneutics constituted a fundamental framework for my understanding and interpretation.
Theory of truth	Correspondence theory of truth: one-to-one mapping between research statements and reality.	Truth as intentional fulfilment: interpretations of research object match lived experience of object.	I believe that lived experience influences one's interpretation of research findings.
Validity	Certainty: data truly measures reality.	Defensible knowledge claims.	I believe that the researcher's life world, context, and research process must be explicit in order to regard the knowledge claims as plausible.

Reliability	Replicability: research results may be reproduced.	Interpretive awareness: researchers recognise and address implications of their subjectivity.	It is critical to acknowledge the subjectivity I brought to the research process and to take steps to address the implications of this subjectivity to ensure the credibility of the study.
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*(Source: Adopted from Sandberg, 2004)*

According to the interpretive paradigm, human beings construct meanings in unique ways, depending on their context and personal frames of reference as they engage with the world which they are interpreting (Crotty, 1998). This is the notion of multiple, constructed realities (Crotty, 1998). In this type of research, findings emerge from the interactions between the researcher and the participants as the research progresses (Creswell, 1998).

Accordingly, subjectivity is valued while there is acknowledgement that human beings are incapable of total objectivity because they are situated in a reality which is constructed by subjective experiences. Furthermore, the research is value-bound by the nature of the questions being asked, the values held by the researcher, and the ways in which findings are generated and interpreted.

In choosing a particular paradigm, certain assumptions and perspectives are accepted. The interpretive paradigm was deemed to be the most suitable for the purposes of this research study because of its potential to generate new understandings of complex, multidimensional human phenomena, such as those investigated in this study (creativity, co-creation and collaboration in project management). Specifically, practical knowledge, which is embedded in the world of meanings and of human interactions, was sought. It was, therefore, considered appropriate to investigate the research phenomenon within the interpretive paradigm.

Hermeneutics formed a fundamental framework for my understanding and interpretation since I am always a part of what I study and, thus, I have an influence on it and it is be hard to claim objectivity.

This was a study of interpretation in how I come to know what I know, how I use that knowledge, how I, as opposed to others, see it and how I work at improving my skills through learning and planning. "Truth keeps happening" (Weinsheimer 1985, p. 9), this is another way of saying that Being is an event of truth. Thus, the study hermeneutic in my acknowledgement of past, present and future understandings as well as in my acceptance that there is no external truth to be found.

### 1.7 Research problem statement

The failure rate of projects is an ongoing problem in many industries, especially in volatile, fast changing industries. Organisations are making massive investments in projects but are failing to realise a return on these investments and value creation out of the projects. One in three information systems projects fail because projects either miss the targets or fail to deliver the required business functionality (Reich, 2007). A number of contributors to the project management body of knowledge (PMBOK) have cited the inability to deal with the complexity inherent in projects as one of the key factors leading to this high failure rate. Reich and Sauer (2009) identified the following five directions of PMBOK, namely, complexity, social process, value creation, broader conceptualisation of projects, and reflective practice. They went further in emphasising that rethinking project management starts with a new appreciation of the complexity of certain projects.

These five directions are reiterated in the craft of project shaping by Winter and Smith (2010) and listed below:

- 1) From the lifecycle model of projects and project management – towards theories of the complexity of projects and project management.
- 2) From projects as instrumental processes – towards projects as social processes.
- 3) From product creation as the prime focus – towards value creation as the prime focus.
- 4) From narrow conceptualisation of projects – towards broader conceptualisation of projects.
- 5) From practitioners as trained technicians – towards practitioners as reflective practitioners (Smith & Winter, 2010).

Based on point 4 above – from a narrow conceptualisation of projects to a broader one – I wish to build on the foundation of the phenomenon of the four project types referred herein in Section 1.2.1. This was echoed in the introductory paragraph, which included the conclusive remarks at the 2014 PMI conference, namely, that the current project management paradigm does not fit certain projects. The suggestion is that exploration projects are a subset of such projects. By nature, they involve a diffusion of innovation in project management and require organisations to develop new mind-set in order to find new ways of managing these projects s embedded practices obscure and overlook strategically critical innovations.

In their paper on emergent trends and passing fads in project management research, “A scientometric analysis of changes in the field”, Pollack and Adler (2015) revealed that, since 2009, the keyword “innovation” has emerged in the project management body of knowledge. They further suggested that “innovation” and “new product development” imply that project management has recently been come to be viewed as a potential way of driving or managing change and innovation within organisations. They then concluded that this suggested a movement away from technical and industry-specific issues to an emphasis on the interpersonal aspects of project management and the role of project management in the broader organisational context.

This is in line with Svenjvig and Andersen’s (2015) paper on rethinking project management, in which they uncovered six emerging, overarching categories in the literature on rethinking project management:

*Table 2: Six categories from the rethinking project management literature*

Categorisation	Description
Contextualisation	Expanding the conception of the project to encompass elements such as the environment and organisational strategy (e.g. Dille & Söderlund, 2011)

<b>Social and political aspects</b>	How social and political processes shape projects, e.g. power structures, emotionality and identities (e.g. Smith, 2011)
<b>Rethinking practice</b>	Offering or suggesting alternative methods, perspectives and ways to rethink practice, e.g. through education or reflective practice (e.g. Crawford et al., 2006; Kreiner, 2012; Thomas & Mengel, 2008)
<b>Complexity and uncertainty</b>	Outlining the complexity of projects, their environment, etc. and new methods to cope with such complexity (e.g. Lenfle & Loch, 2010)
<b>The actuality of projects</b>	Outlining the need to study how projects are actually carried out or empirical studies on the actuality of projects (e.g. Blomquist et al., 2010; Packendorff, 1995)
<b>Broader conceptualisation</b>	Offering alternative perspectives on projects, project management and project success or outlining how the field is broadening beyond its current limits (e.g. Sahlin-Andersson & Söderholm, 2002)

(Source: Svenjvin & Anderson, 2015)

All six categories mentioned above are important areas of focus in the rethinking project management stream. However, for the purposes of this research, I focused on the four areas of contextualisation, rethinking practice, complexity and uncertainty and the broader conceptualisation of projects.

Thus, this study sought to contribute to the existing project management body of knowledge (PMBOK) research on best practices for projects characterised by high levels of uncertainty and which demand creativity in project teams in order to birth innovation in such projects (referred to in this study as exploration projects) by building new knowledge in the rethinking project management literature.

### 1.8 Research context: Exploratory sandpit projects

The Sandpit concept was conceived by the UK's Engineering and Physical Science Research Council in 2003 as interactive workshops with multidisciplinary mix of participants, some active researchers and others potential users of research outcomes to address research challenges (Dugan, 2016). There are two conceptions of educational sandpits in Africa; namely, the Educational Technology Inquiry Laboratory (ETILAB) at the University of Cape Town, which focuses on empowering educators to develop "home-grown solutions" to education using technology and the African Science Leadership Programme (ASLP), which is aimed at empowering mid-career African academics in the areas of thought leadership, team management and research development. The common factor in both these sandpit concepts is the mandate to draw on multidisciplinary teams to co-create innovative projects that address persistent problems within the given context. The projects are initiated, refined, designed and implemented within a short time, namely five days, in order to build contextually relevant solutions. The framework that emerged from this study may be applied to exploratory sandpit projects. The justification of this research context is elaborated later in Chapter 2.

### 1.9 The research objectives

The main objective of this study is to propose a new practice in managing projects characterised by a high level of uncertainty, ambiguity, complexity and emergence (referred to in this study as exploration projects) by creating an enabling project environment and thinking environment that embraces creativity and ambidexterity in order to encourage innovation and novelty in projects.

In order to achieve this overarching objective, it was deemed necessary to

- understand the existing project management body of knowledge and its proposed strategies to deal with uncertainty in projects and identify gaps in the knowledge
- understand the design thinking in this study as a possible solution to address the gaps identified above and also enable the culture of creativity necessary in projects



- apply the emerging practice which was abductively developed from the outcomes of the above in the real-world project situations and assess the outcome of the application of this practice
- refine the proposed practice in the light of the outcome of the empirical study.

### 1.10 Research questions

The original research question was as follows: *How may projects characterised by high levels of uncertainty and ambiguity be managed?*

This was the overarching research question which was further explored through a sub-question which emerged from the literature review, namely:

*What is the role of the project classification school of thought in project contextualisation?*

Firstly, the study attempted to make a case for the classification of projects, arguing that the “one size fits all approach” to project management is misleading and disadvantages project managers in the real-world context which is characterised by significant change and uncertainty. In addition, the mechanistic, linear, simplistic approach to projects also stifles both creativity and the potential in projects to generate novelty and lasting relevance in projects. It was, however, necessary to recognise the complexity of a project as well as the level of ambiguity and uncertainty regarding the project objectives and skills and then choose a non-conventional entry into the project such as that proposed in this thesis.

The school of project classification, which was proposed by a number of writers (Aucoin, 2007; Lenfle, 2013; Obeng, 2003; Turner & Cochrane, 1993), serves as a fundamental factor in deciding on the context of the project and then deploying various methodologies or approaches to manage the project.

This upfront approach should enable project managers to relinquish their assumptions as well as their perceptions about the status quo, face value and superficial facts relating to projects and then to delve

deeper into unknown information that may redefine the project vision and direction to allow greater impact and novelty than may otherwise have been the case.

I decided to investigate the existing project management body of knowledge and to seek project management phenomena that I could build upon to answer the research question. The school of project classification provided a theoretical foundation on which projects could be classified into different categories. The main type of project addressed in this thesis is the highly complex project (referred to in this study as an “exploration” project, which starts from at a point where both the project objectives and skills are unknown.

Through further research into the project management body of knowledge I learnt that there were gaps in the literature as regards the guidance leadership and implementation of such projects. This a more refined, specific research question, namely, *“How to facilitate an enabling project environment that stimulates creativity and encourages co-creation in exploration projects?”*

This overarching research question was then divided into the following two sub questions during the literature review process, namely:

1. *What are the design thinking and creative problem-solving principles that may enrich the process of vision creation and conceptualisation in exploration projects?*
2. *How may the emerging design principles be enhanced through experiments to ensure a more practical framework for managing exploration projects?*

### 1.11 The research design and methodology

The field selected for the purposes of the study was the education field. This choice was largely influenced by my position as a researcher working in the educational sector. In addition, I had sought a field in which I would be able to have access to real-life settings in which the impact of the empirical research could be tested in an authentic, open environment while be able to work closely with

practitioners in the field of study.

This is an exploratory study in multidisciplinary fields, in which a gap was identified in the project management body of knowledge, namely, the inability to provide substantial knowledge or guidance for the management of exploration projects. Design thinking, which was conceived in the design field but which has been recently adopted in management studies, was found to provide a human-centric, integrative, plausible approach that could address this gap and which could be adapted for the management of exploration projects. A design model was then built based and tested in the education field.

It was, thus, essential that the research approach reflected a deep understanding of the concept of educational sandpits. Thus, it was incumbent on me to understand the communities of practice in the field of educational sandpits and the challenges faced by researchers and practitioners and, therefore, test the propositions with a depth of understanding. The testing was, however, different from a hypothesis test as I had to work very closely with practitioners in the field to develop, test, reiterate, refine and improve the design model to ensure practicable, innovative outcome.

A qualitative approach was selected and thus the data collection methods used were aligned with the requirements of this research design. Qualitative research is a research methodology that focuses on an in-depth understanding of the behaviour of humans and the motivations that govern human behaviour. In short, this research method investigates how and why individuals and groups understand or view the world around them.

The journaling and personal observations were given special attention and informed the majority of the data collection during the workshops. The workshops material, presentations, artefacts and photographs were also collected to inform the study. The data collection methods and justification are discussed below at length in Chapter 3; semi- structured interviews are another tool used in inquiry (Fetterman, 1988). These interviews took the form of a dialogue or interaction and constituted a conversation with a purpose. With the permission of the participants the interviews were videotaped

to ensure that the data was captured more faithfully after the interviews than may otherwise have been the case. This also allowed me to focus my attention on the interview and not on hurried note keeping. In Page 17 and 18, I mention how the color coding of texts from the various sources, which helped to identify the various sources of the data collected in the study. A follow-up survey was administered approximately one week after the workshops. These surveys were conducted online using the online course management system. All the survey responses are anonymous. The responses are presented in appendix 8 and appendix 15 and were used during the data analysis process.

Accordingly, the design-based research (DBR) approach was adopted for the purposes of this study as it was deemed to be the most suitable approach. This choice was congruent with the arguments of Reeves (2000, p. 9) who made a clear distinction between research conducted with traditional empirical goals and that inspired by the development goals leading to "design principles". The aim of this study was to develop design-thinking practices for exploration projects. The DBR outlines practical steps to follow and involves both practitioners and researchers in the establishment of innovative outcomes that are practically relevant.

Barab and Squire (2004) defined DBR as "a series of approaches, with the intent of producing new theories, artefacts, and practices that account for and potentially impact learning and teaching in naturalistic settings". Thus, DBR has significant potential as regards enhancing both the theoretical contributions and the public value of research in the educational field (Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006).

The impact of research in the educational field as regards contributing to theoretical understanding and enhancing real world teaching and learning has long been called into question (Reeves, 2006). DBR protocols require intensive and long-term collaboration involving both researchers and practitioners.

The main aim of this study was to gain an understanding on how the project artistry process may facilitate the clarity of project vision that leads to more novel, contextually relevant solutions to local

problems than may otherwise have been the case.

DBR integrates the development of solutions to practical problems into learning environments with the identification of reusable design principles.

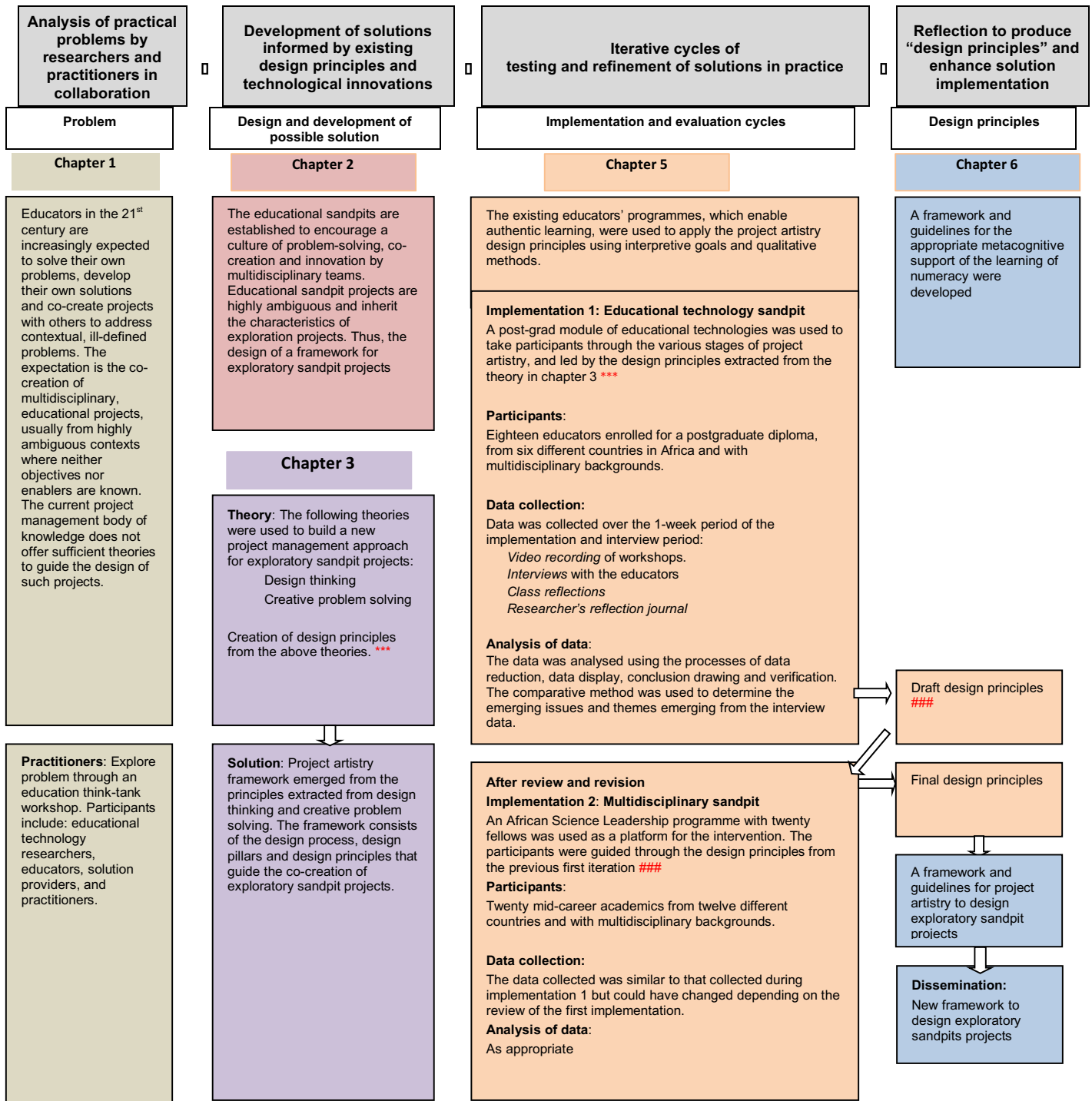
Brown (1992) and Collins (1992) are widely acknowledged as early contributors to the definition and activation of DBR. They described DBR as a methodology that requires

- addressing complex problems in real contexts in collaboration with practitioners
- integrating known and hypothetical design principles with technological affordances to render plausible solutions to these complex problems, and
- conducting rigorous and reflective inquiry to test and refine innovative learning environments as well as to define new design principles.

In the *Handbook of design research methods in education*, Kelly, Lesh, and Baek (2008, p. xiii) state that “successful design research uses design processes, grounded in context of use, to inform and to be informed by the practice of research methods in order to develop principles, heuristics, models and theories about design in learning and teaching settings”.

## 1.12 The research model

### A page plan for design-based research: (Project Artistry Framework for Exploratory Sandpit Projects)



A page plan for design-based research (Adapted from Reeves (2006, p. 59))

The research model above depicts my journey as a researcher using a design-based research approach to guide this inquiry. The four main stages in Figure 2 map the journey that was undertaken during this research study and are elaborated below.

### **Stage 1:**

The process started with a needs analysis phase that entailed an understanding of the problem, the root causes of the problem and the practical realities faced in the education field. The researcher and the practitioners in the field conducted the needs analysis during a two-day think tank workshop at which key stakeholders in the educational field were represented.

Several themes emerged from the workshop at which rigorous discussions of educational problems were held. This resulted in the establishment of one main intervention point in the education field. These themes are tabled in Appendix 9. Using these themes, causal loop modelling was then conducted to further establish that the main intervention point in the education field is the “educator”. This was elaborated in Chapter 3.

### **Stage 2:**

During this stage a study of the gap in the existing project management body of knowledge was conducted. It was found that the project management body of knowledge did not adequately equip practitioners to engage in highly complex, volatile, uncertain, wicked projects. It was decided to use design thinking principles and creative problem-solving principles to address this gap in the project management field and propose a set of new practices, herein referred to as project artistry, which could improve the management of exploration projects.

In addition, an understanding of the educational sandpits concepts was required to apply these emerging design practices in the education sandpits that guide the development of real world, to test the effectiveness of the proposed project artistry design principles.

### Stage 3

The outcome of stage two was a prototype of the design process that governs exploration sandpit projects. This prototype was tested by practitioners and researchers in real-life situations. At this stage, a one-week module dedicated to the educational technology development of postgraduate students at the University of Cape Town was identified as a platform on which to carry out this undertaking to refine and test the proposed design process.

In this module, students are expected to develop a technological artefact that addresses an educational problem in their respective fields. This presented an opportunity for the students to be taken through the proposed design process that would guide them in the development of the project. Chapter 3 presents the details of this empirical study.

The next iteration was carried out in a multidisciplinary sandpit which was held at the University of Pretoria and where a one-week workshop was held for twenty educators from various countries in Africa. They were led through a project artistry framework designed to conceive the multidisciplinary projects that address the leadership problems that exist in academia.

### Stage 4

During the final stage reflections on the entire process led to a deep understanding of the research problem, a redefinition of this problem and the adjustment of the original design process proposed. All the iterations above were then refined to enable a more practicable design process than had originally been the case.

The choice of the design-based approach led not only to the generation of new knowledge but also to the establishment of an authentic environment that impacted positively on educational researchers and practitioners.



### 1.13 Organisation of the thesis

The thesis is organised into seven chapters. Chapter 1 frames the research problem and presented an overview of the entire study, including the research questions. The research questions were answered by the use of a research methodology that was applied in the educational sandpit context. Chapter 2 contains the literature review and established the context of the thesis, namely, educational exploration projects. This is a multidisciplinary thesis and, hence, concepts from various journals in project management; management studies and educational research constituted the theoretical foundation of the study.

Chapter 3 focuses on the development of the project artistry framework and the research paradigm. The research design and research methodology are covered in Chapter 4 while the conceptual framework that outlined the DBR applied in the thesis was described at length. This sets the scene for a detailed analysis of the various data collection stages, the iterations carried out and the enhancements of the design principles that emerged from the research findings in Chapter 5. The discussion of the research findings and the analysis of these findings to evaluate the artefacts in Chapter 6 also make reference to the research paradigm, research method, data collection and study findings. Finally, in Chapter 7, I argue in support of the relevance and persistence of this study in providing a synthesis and justification for the entire study. The contributions of this research endeavour are explicitly deliberated while the limitations of this study and possible areas of future research are also discussed.

### 1.14 Chapter 1 summary

Chapter 1 presented the research problem, motivation for the study, and significance of the study, as well as the research methodology used and the researcher's positionality. Chapter 2 contains the review of relevant literature and establishes the research context.

## Chapter 2: Literature Review

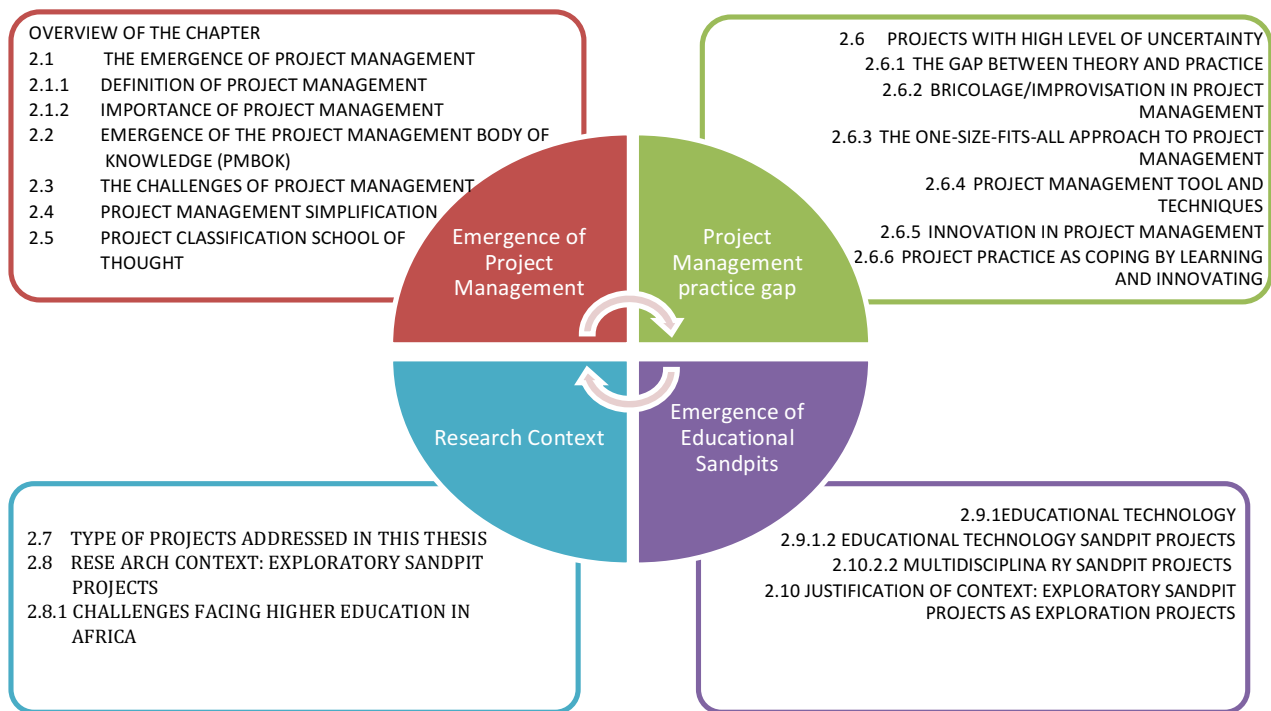
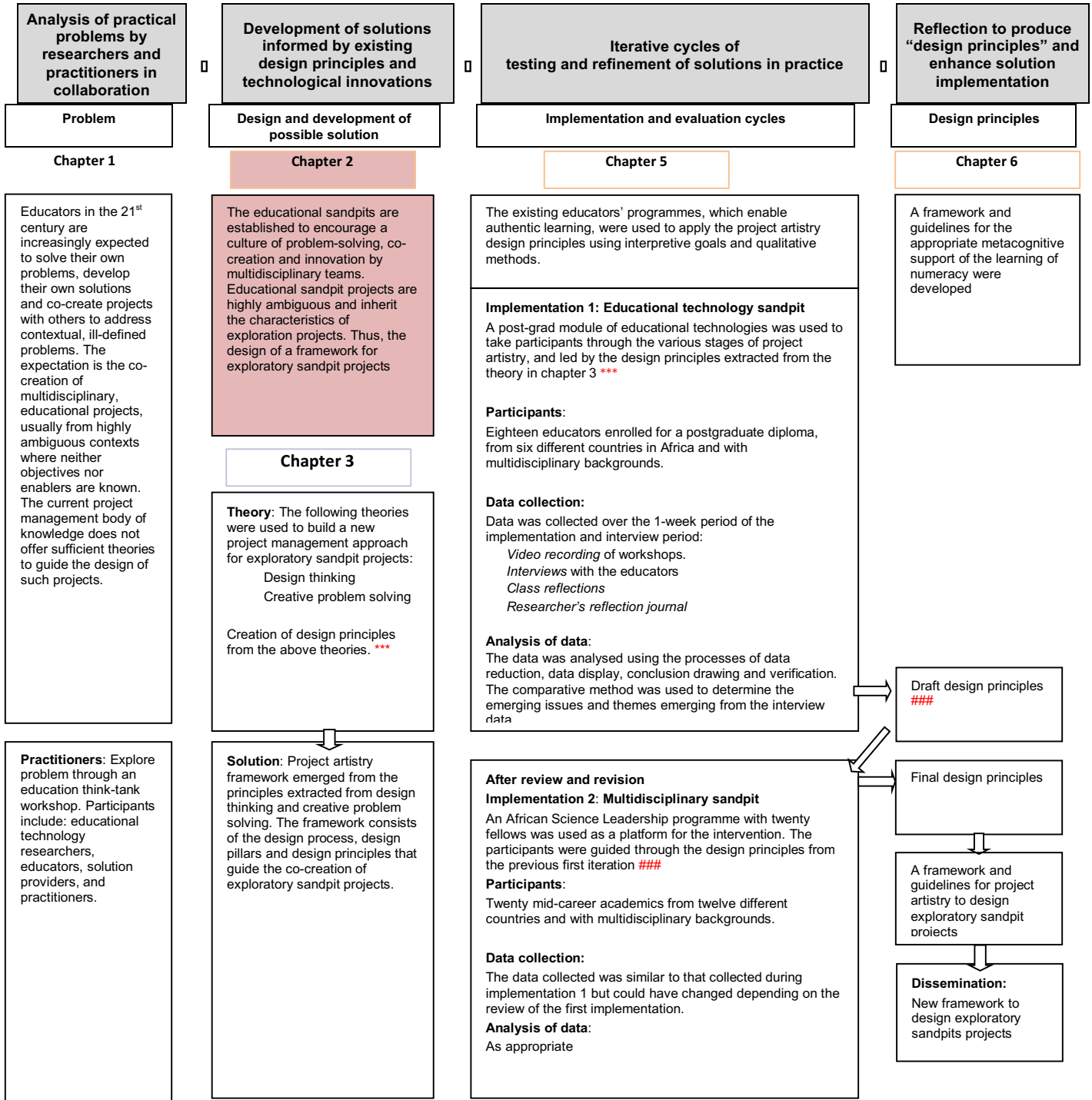


Figure 2: Overview of Chapter 2

## Chapter 2 – Literature review highlighted in the context of this study

A page plan for design-based research:



Adapted from Reeves (2006, p. 59)

## Overview of the chapter

The previous chapter introduced the research foundations, motivation for the study, research objectives and research questions and provided an overview of the study. This chapter contains the literature review that informed the study. According to Fraenkel and Wallen (2006), a literature review assists researchers to glean the ideas of others who were interested in a particular research question. Fraenkel and Wallen (2006) formulated the following sequential “steps involved in a literature search”:

- 1) Define the research problem as precisely as possible.
- 2) Examine relevant secondary sources.
- 3) Select and peruse one or two appropriate general reference works.
- 4) Formulate search terms (key words or phrases) pertinent to the problem or question of interest.
- 5) Search the general references for relevant primary sources.
- 6) Obtain and read relevant primary sources, and note and summarise key points in these sources. (p. 68)

These steps guided the literature review discussed in this chapter. The main focus of the literature review was to clearly articulate the knowledge gap in the project management body of knowledge that this thesis wished to address.

### 2.1 The emergence of project management

This section describes the foundations of the claims made in the thesis and as contained in relevant literature. Because the existing gap in the field of project management had been identified, it was deemed important to first discuss the emergence of project management as a field. Project management is extremely popular in all fields, industries and regions. On 16 February 2015, when Google was used to search “project management”, half a trillion results were found and this, despite the fact that, according to the 2013 Chaos Manifesto report by the Standish group, there has been little

improvement in the delivery of projects (Schwalbe, 2007). It was, therefore, important to ensure an understanding of the credible sources of project management information and the original manuscripts and how this body of knowledge has been built up in order to understand the existing gaps in the body of knowledge. Without a prior understanding of the foundational principles of project management it would be easy to overlook some of the fundamental causes of the current problems evident in the body of knowledge. Accordingly, this section addressed the emergence of project management.

Much has been written on project management. Numerous challenges have emerged and have been documented in various journals. It was considered to elaborate on the challenges which were specifically addressed in this thesis. Six challenges emerged and are discussed in detail in this section.

### 2.1.1 Definition of project management

To understand the concept of project management and its foundations, it was crucial to explore the term “project management” and to define its individual components.

#### **Project:**

The Oxford Dictionary defines the word project as “something that is contemplated, devised, or planned” or “a large or major undertaking, especially one involving considerable money, personnel or equipment”. Both these meanings refer to the concept of a project as a purposeful undertaking involving resources. On the other hand, PMBOK defines a project as “*a temporary group activity designed to produce a unique product, service of result*” (PMBOK, 2014). The following five characteristics of a project emerge from these definitions:

- Temporary activity
- Time-bound
- Purposeful
- Designed activity
- Unique outcome.

Hence, a project may be referred to as a temporary undertaking, which is time-bound and purposeful, and which is designed to produce an outcome, be it a product, service or result.

**Management:**

The Oxford Dictionary defines the word management as “*an act or manner of handling, direction, or control*”. This implies that the concept of management implies the ability to be in control, to give direction, instruction, or to directly influence or handle the situation that is being managed. This meaning is important in the context of this thesis and the actual notion of whether projects must be guided, managed, organised, crafted, led, or designed is argued later in this chapter.

**Project management:**

Based on the above definitions, project management may, therefore, be referred to as a way of controlling or directing resources to achieve a specific, time-bound purpose. This resonates with the PMBOK definition of project management, namely, the “application of knowledge, skills, (and) techniques to execute projects effectively and efficiently” (PMBOK, 2015).

**2.1.2 Importance of project management**

Project management has remained one of the key strategic areas of organisations, governments, and institutions. In addition, it has gained momentum with the increased focus on strategic positioning in the fast-changing business landscape. Projects are interventions in organisations that allow such organisations to implement strategic initiatives in order to achieve organisational goals. The permeation of project management in organisations occurs across all industries, fields of study and both small and large organisations. It may refer to diverse undertakings, be it the development of brand new products or services, improving or enhancing current products or services or a complete change of strategic focus. This all highlights the fact that project management has become an extremely important and powerful tool in the hands of organisations that understand its use and have at their disposal the competencies required to apply it. Since its theoretical conception over 50 years

ago, project management has become one of the dominant practices in terms of which work effort is organised and directed within an organisational context (Thomas, 2006).

## 2.2 Emergence of the project management body of knowledge (PMBOK)

This section discusses the emergence of the field of project management as a field from the time it was conceived in the early 20<sup>th</sup> century until the millennium. It is important to understand the foundations of project management and how it emerged as a field from its inception. The founding principles help the understanding of the theoretical and practical basis of the field and the challenges confronted.

According to Kwak (2003), it would appear that the project phenomenon dates from more than 4500 years ago with the construction of the ancient Egyptian pyramids. Later, about 2500 years ago, Sun Tzu wrote about planning and strategy, stating that “every battle is a project to be first won then fought” (Weaver, 2007). This was followed by the construction of transcontinental railways during the 19<sup>th</sup> century and the construction of buildings of various sizes and complexity until today (Weaver, 2007). This implies that projects were carried out for millennia with or without relevant bodies of knowledge and best practice.

It was only approximately fifty years ago that organisations started to apply systematic project management tools and techniques to projects. It has been suggested that the first signs of formal project management practice emerged in the 1950s when both the programme evaluation and review technique (PERT) and critical path management (CPM) were used in engineering, defence and aerospace projects (Crawford et al., 2006, Sewchurran, 2008). However, it has also been suggested that project management practice dates as far back as 1910 with the introduction of the Gantt chart by Henry Laurence Gantt (Jamshad, 2010). The argument of when the formal practice of project management began is immaterial for the purposes of this thesis although it is important to note the common understanding among writers that the founding philosophy of project management was based on “command and control” (Whitty & Schulz, 2006).

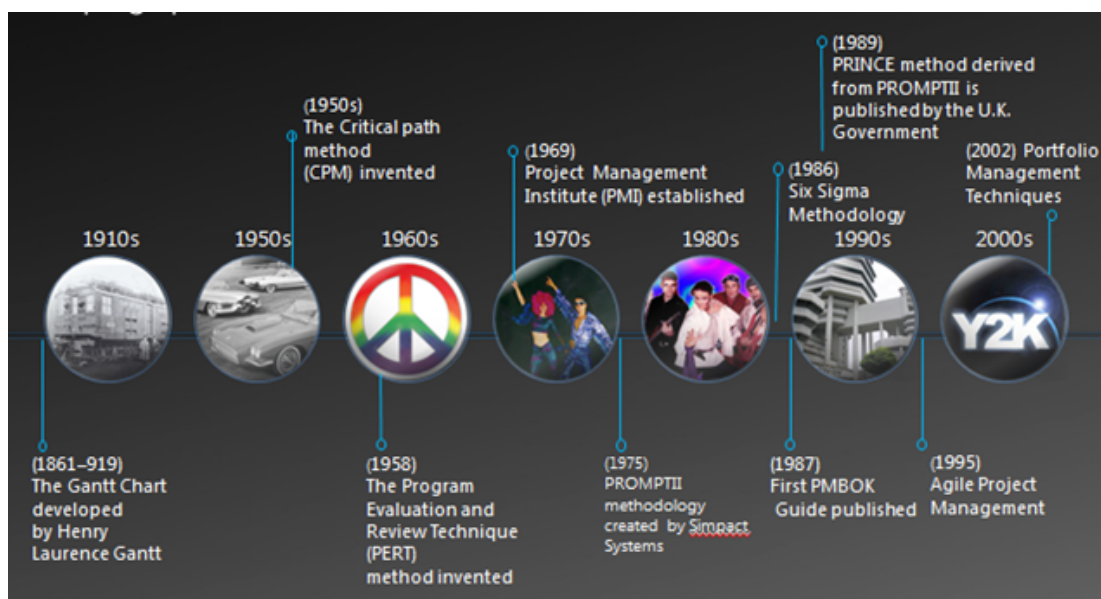


Figure 3: Emergence of project management

(Source: <http://geekdeck.com/evolution-of-project-management-tools-methods/>)

Figure 4 above represents a graphical depiction of the emergence of project management and presents a brief summary of the important occurrences in the project management field. During the 1960s and 1970s, the United States Department of Defence, NASA, and large engineering and construction companies utilised project management principles and tools to manage large budget, schedule-driven projects. In the 1980s, the manufacturing and software development sectors started to adopt and implement sophisticated project management practices while, by the 1990s, project management theories, tools, and techniques had been widely embraced by various industries and organisations.

Snyder and Kline (1987) noted that the modern project management era started in 1958 with the development of CPM/PERT while Morris and Hough (1987) argued that the origin of project management comes from the chemical industry just prior to World War II and further noted that project management was clearly defined as a separate discipline in the Atlas Missile Programme and, especially, in the Polaris Project.

There are several ongoing debates on the management approaches associated with project management. Some writers point to the origin of project management as Henri Fayol's (1916) five



functions of a manager, namely, (1) to plan, (2) to organise, (3) to coordinate, (4) to control, and (5) to direct or command (Kwak, 2003). Henri Fayol's (1916) fourteen principles of management include division of work, authority and responsibility, discipline, unity of command, unity of direction, subordination of individual interests to general interests, remuneration of personnel, centralisation, scalar chain, order, equity, stability of tenure of personnel, initiative, and esprit de corps (union is strength). Weaver (2007) is of the opinion that these elements all resonate strongly in the core elements of the project management body of knowledge.

In 1911, Frederick Taylor,<sup>5</sup> known as the Father of Scientific Management, published *Principles of Scientific Management* in which he proposed work methods designed to increase worker productivity. Famous experiments conducted involved increasing the output of a worker loading pig iron onto a rail car. Taylor broke the job down into its smallest constituent movements and timed each movement with a stopwatch. The job was then redesigned with a reduced number of motions as well as reduced effort and a reduced risk of error. The Taylor model gave rise to dramatic increases in productivity. This 'reductionist' approach to complex endeavours; supported by the division of labour, is central to scientific management as well as to numerous modern project management processes such as the development of the 'Work Breakdown Structure' (WBS) and scheduling. This approach is also known as the Taylorist approach in project management and it significantly influenced the origins of project management.

Henry Gantt<sup>6</sup> (1861–1919) also belonged to this school of this thought. He developed a range of charts which focused on comparing planned (or intended) production with actual production with the aim of identifying the causes of any variances. He also developed motivational schemes, emphasising the greater effectiveness of rewards for good work over penalties for poor work.

Sewchurran (2008) challenged these foundational principles of project management based on command and control and referred to Drucker's approach to management, which differs from Taylor's

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<sup>5</sup> For more information about Frederick Taylor - [https://en.wikipedia.org/wiki/Frederick\\_Winslow\\_Taylor](https://en.wikipedia.org/wiki/Frederick_Winslow_Taylor)

<sup>6</sup> For more on the work of Henry Gantt - [http://www.mosaicprojects.com.au/Resources\\_Papers\\_158.html](http://www.mosaicprojects.com.au/Resources_Papers_158.html)

thinking. Drucker believed that the primary role of management is the establishment of managerial attitude rather than emphasising the direct control through intensive surveillance, heightened visibility and accountability in Taylorism (Sewchurran, 2008).

Cicmic and Hogson (2006) points out that the PMBOK demonstrates a distinct tendency toward Taylorist direct control, intensive surveillance, heightened visibility and accountability, while Sewchurran (2008) goes further in show that, in the Taylorist approach to management, power is used in the manner in which it is conventionally understood, namely, as something that controls by prohibition and rank.

However, in the modern management era, characterised by Drucker's influence together with Peter Checkland's soft systems thinking and Peter Senge's systems thinking, power is used in a significantly more implicit, tactful, and circumspect sense. It may be deduced from these efforts that management involves inspiring an organisational pattern. In the systems thinking era power was used to change perceptions, introduce subjectivity, stimulate motivation, and invoke passion and commitment. All of these are aimed at cultivating a managerial attitude, as advocated by Drucker (Sewchurran, 2008).

Thus, project management requires a blend of instrumental rationality, intuition and "the feel for the game" in a context while being-in-the-world. Cicmil and Hodgson (2006) suggested that an alternative perspective is required in order to take into account the practice of project management as social conduct, defined by history, context, individual values, and wider structural frameworks.

According to Sahlin-Andersson and Soderholm (2002), one of the attractions of project management as a way of organising is the ambitious promise of project processes that are able to deliver both controllability and adventure. This promise assumes that a project's processes are capable of providing a learning environment that fosters creative levels that enable the generation of new knowledge, skills and attitudes. Projects are, therefore, seen as vehicles with which to deliver complex products (Hodgson & Cicmil, 2006). Nevertheless, the literature on project success shows that certified practitioners have not resulted in a dramatic improvement in project success rates

(Schwalbe, 2009; Sewchurran, 2008).

There are several ongoing debates about project management and its efficiency in improving project success and outcomes in practice. Many attribute its failure to be relevant in the changed management paradigm to the foundations of the old, Taylorist approach of control and command and the perception of project management as a mechanistic process, carried out in a predictable and stable environment. Researchers have expressed numerous views, questions, problems and challenges and made several suggestions on how the body of knowledge may be improved. The next section discusses the challenges of project management that were deemed relevant to this thesis.

### 2.3 The challenges of project management

The Standish group<sup>7</sup> is renowned for the studies it conducted on IT project success (Schwalbe, 2007). Their research reports have become infamously referred to as the Chaos Reports, presumably because they highlighted the chaotic nature of information technology projects. The first study was conducted in 1994 and indicated that, on average, 16% of IT projects only were considered successful. Several repeat studies have since been conducted. A follow up study conducted in 2002 showed 32% of the projects had been deemed to be successful, thus indicating that the percentage of successful projects had almost doubled since 1994. A study conducted in 2004, however, showed that success rates had fallen from 32% to 29% (Schwalbe, 2007, p. 15). On the whole, these studies show that there had been a moderate improvement but, more importantly, they imply that, on average, one out of three projects only tend to be successful. This finding did not show the usefulness of the project management profession in good light. Since the publication of the Chaos Reports there has been a sustained focus on understanding the success and failures in this arena.

The table below was extracted from the 2013 Chaos Manifesto Report.

**Successful:** Delivered on time, within budget estimate and with required features and functions

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<sup>7</sup> <https://www.projectsmart.co.uk/white-papers/chaos-report.pdf>

**Failed:** cancelled prior to completion or delivered and never used

**Challenged:** May be late, over budget, and/or with less than the required features and functions

Table 3: Project resolution from 2013 Chaos Manifesto Report

	2004	2006	2008	2010	2012
Successful	29 %	35 %	32 %	37 %	39 %
Failed	18 %	19 %	24 %	21 %	18 %
Challenged	53 %	46 %	44 %	42 %	43 %

(Source: <http://lbog.standishreport.org>)

Both researchers and practitioners have conducted post implementation reviews to understand the reasons for failures and successes. These post implementation reviews revealed that sound project management and effective business leadership were fundamental to achieving success and that these elements were often lacking in initiatives that failed (Ackermann et al., 1999; Kettinger, 1997). Since 1994 the refinement of the PMBOK and the introduction of formal project management have contributed to a marginal improvement in project success rates. However, the research conducted by the Standish group has shown that, despite ongoing refinement, there has not been any dramatic improvement as, on average, it appears that one out of three projects only could be considered successful. Nelson (2007) reported similar statistics in a study of 99 projects in North America. While the accuracy of these statistics may be debated and they could be presented in more stratified ways, the wider areas of concern about the state of the discipline's knowledge about the project phenomenon and theories relating to the management of projects stand out.

## 2.4 Project management simplification

Project management failure appears to be most prominent in the areas in which the problems encountered are characterised by high degrees of organisational change and intangible end products (Sauer & Reich, 2007). A possible reason cited by Crawford et al. (2006) was that the success of these projects depends on the participation, reactions and interactions of people. A further reason cited was

that these projects are directed at organisational improvement and change which must extend beyond the initial construction phases to ensure the realisation of the project objectives. Project implementation affects the routine practices of people. Such changes may result in complexities which impact on the social and cultural structure of organisations. It would appear that the project management practices developed and which are entrenched in tools and techniques have not changed as substantially as the range of problems to which project management is applied (Crawford et al., 2006).

The development of the project management practitioner is pre-eminently focused on both the roles of the project team and on the explicit knowledge that is required (Crawford et al., 2006). However, this focus is counter-intuitive because, although projects are characterised by similar phases, a project is defined as a new undertaking. Hence, project work is not supposed to be solely dependent on functionalist, normative behaviour. The emphasis on the explicit knowing required is misdirected in projects which are characterised by intangible end products as the emphasis in such cases should be coping and learning in the complex environments in which practitioners work (Cooke-Davies, Cicmil, Crawford & Richardson, 2007). It may well be that, as a result of the process of simplification, the need to support practitioner development and the transferability of practice, the body of project management knowledge has been simplified and generalised. This commoditisation has resulted in a discourse that does not offer much to the practitioner who is immersed in a project management role because project management practice is typically characterised by ambiguity, complexity and uncertainty. These concerns have resulted in calls for theory that assists in the understanding of the conditions and circumstances that may lead to both functional and dysfunctional behaviour instead of mere specific advice that assumes a stable, social world (Sauer & Reich, 2009).

## 2.5 Project classification school of thought

Several writers (Aucon, 2010; Obeng, 2007; Winter, 2009) suggest that projects be classified according to the uncertainty of various key characteristics such as project objectives and level of skills. The matrix below presents a graphical depiction of the four different types of projects as defined by

these writers.

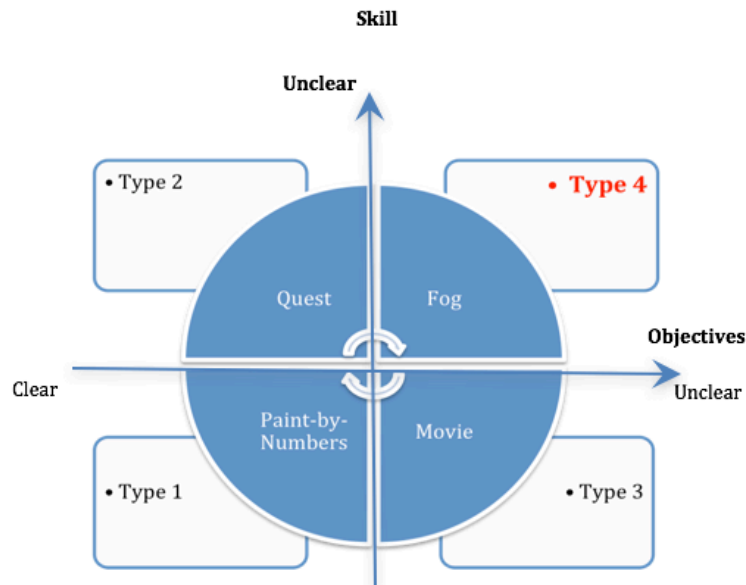


Figure 4: Project types

Type 1 projects are highly predictive and clearly defined. The project objectives are clear, and there are the skills available which are required to deliver such projects. Examples of such projects include construction projects and brick and mortar projects with clear, predictable environments, which may be easily managed through the allocation of resources and monitoring and evaluation. The PMBOK principles are founded on this school of thought and may, therefore, equip project practitioners to lead such projects. However, projects characterised by higher levels of uncertainty present challenges.

Clear

## 2.6 Projects with high level of uncertainty

There projects defined by high levels of uncertainty and are difficult to manage using the old-fashioned tools that were designed for simple projects. Type 2, 3 and 4 projects are characterised by at least one level of uncertainly regarding the key variables in the delivery and implementation of the project. Unknown or unclear objectives mean that the members of the project team are forced to navigate the unknown territories together and try to define these objectives as they proceed with the

project. This requires “building a bridge as one walks in it”. In addition, it also requires the type of leadership that establishes a creative environment and allows individuals and teams to tap into the power of individual and collective creativity to shape the project while working on it. Winter (2008) maintains that such projects require, not a tactical manager, but a project shaper who facilitates the creation process rather than managing people in their performance of tasks. The concept of the project shaper presents project management as more of an art than a science, with the approach to the project stemming from the fact that each project is unique, is expected to produce unique outcomes and addresses unique challenges. Hence, projects require leadership that establishes both a creative culture and an environment that allows the co-creation and generation of an innovation in every project.

The foundational principles of project management discussed above have resulted in persistent and ongoing debates on the challenges of project management. In the context of this thesis, the following four persistent challenges that have remained are discussed. These are based on the fundamental principles addressed in this thesis.

The following challenges have remained relevant and persisting problems in the project management of exploration projects

### 2.6.1 The gap between theory and practice

Firstly, there have been numerous debates on the issue of bridging the gap between theory and practice in project management with some promoting a more practice-led research as compared to theory-led practice. Klein et al. (2015) suggested praxeology as a method of enquiry in project management although this would always result in praxis and more practice-led theory. The dichotomy between the eloquence of the theory and its lack of impact on practice remains a key issue. Theories about project management tend to lack applicability and while those who practice appear to lack platforms for theorising about and influencing the project management body of knowledge. These discourses may be observed throughout the project management body of knowledge and remain one

of the key issues.

### 2.6.2 Bricolage/improvisation in project management

Project management is an extremely complex issue and, thus, it is fruitful ground for creative, spontaneous and intuitive applications of particular theories to meet the stated objectives in a constantly changing environment.

This form of work is defined as improvisation, which describes a pragmatic approach of applying existing theories in novel ways in order to deliver a successful project. The combination of a solid, theoretical knowledge base and improvisational practices constitutes the approach used in this study to conceptualise a praxeology of resilient project management

The increased complexity of project management often renders the proposed tools impractical. This means these tools are consequently not used in practice, thus reinforcing a separation between theory and practice. However, complex tools may not be necessary in order to solve complex problems (Whitty & Maylor, 2009). Instead, a better understanding is required of what project managers actually do in order to transcend the prescriptive and universal nature of current project-management theories in the interests of an improved theoretical understanding of project-management practices and, thus, a praxeology of resilient project management.

### 2.6.3 The one-size-fits-all approach to project management

Secondly, the one size-fits-all approach to projects management does not do justice to the dynamic contexts, environments, industries and natures of various project types. In addition, projects are managed by human beings and are executed by human beings. This adds complexity while the emphasis on mechanistic tools and rigid processes does not empower project managers in the various settings to deal with the complexity inherent in human activity systems. Instead, it hinders the innovation and affordances required to deal with the emergence inherent in projects which are run in



volatile environments and which are characterised by high levels of uncertainty. Project management tools and techniques are based on a deterministic and reductionist approach. This in turn is based on the linear cause-and-effect thinking that is the basis of both the traditional management concepts and scientific principles of management that emerged during the 19th century after the Industrial Revolution. The scope of a project is determined in a mechanistic way and classified into the work breakdown structure, which is the core of project management techniques. However, the challenge that remains is the way in which the scope is broken down when there is ambiguity and uncertainty, and even the stakeholders do not know what they want.

#### 2.6.4 Project management tool and techniques

Thirdly, there are a number of studies which investigated the value of project management tools, such as Gantt charts and work breakdown structures, in terms of their contribution to project success and their usefulness to the practitioner (Besner & Hobbs, 2006; Jugdev et al., 2013). The outcomes of these studies have alluded to the inadequacy of these tools in practice where complexity and ambiguity are realities in projects. For example, White and Fortune (2002) highlighted the fact that these tools are either frequently inadequate for the purposes of complex projects or they are difficult to apply in the real world. Crawford (2005, sec. 4.1), in reflecting on the lack of empirical evidence on project management standards and workplace performance, further suggests “that the knowledge and practices valued by project management practitioners, and embodied in their professional standards, are not the same as the knowledge and practices valued by senior manager”. Winter et al. (2006) further note that it is not the tools or particular products that deliver projects but the people and, hence, the emphasis should be on the people rather than on the tools or products. There are still ongoing debates on the very construct of project management and whether project management is an art or a science or both (Briggs, 2012).

#### 2.6.5 Innovation in project management

Lastly, although the project management literature is starting to recognise the complexity of project

management and project environments and to acknowledge the limitations of the traditional project management approach and tools (Lenfle, 2013), there has been limited innovation in project management regarding the generation of a new approach and new tools. Some of the approaches such as the agile and scrum approach have afforded a level of flexibility as well as the ability to deal with the fast-changing project environments although they have been criticised as being merely an extension of existing approaches and tools and simply giving more of the same results (Dugal, 2014), while what is required are brand-new approaches. Some writers have suggested that new design approaches would introduce new mind-sets and tools into the project management body of knowledge (Dugal, 2014).

#### 2.6.6 Project practice as coping by learning and innovating

The project management definition by PMI cited below creates the impression that project managers engage in rational activities only during the management of projects. According to the PMI, project management is

The application of knowledge, skills, tools and techniques to project activities to meet project requirements and is accomplished through the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling and closing (PMI, 2004, p. 8).

In an attempt to explain the innovative nature of project work and the deviations which may be experienced between the planned and actual work there is a long tradition of research into the operational research discipline. This research claims that the decision makers in operational research face bounded rationality. Sadler-Smith and Leybourne (2009) and Söderholm (2008) discuss the use of improvisation and intuition to explain deviations from rational judgement. Söderholm (2008) points out that best practice prescriptions are devoid of any approaches to deal with unexpected activities. These approaches include innovative action, applying detachment strategies, setting up intensive meeting schedules, and negotiating project conditions. It is not, however, just a coincidence

that these interventions are regularly required during project execution. Innovative action is explained by Söderholm (2008, p. 84) as the ability to deal with unanticipated changes such as schedule conflicts and resource reallocation in order to cater for on-site, short term problem solving.

## 2.7 Type of projects addressed in this thesis

The on-going debate about the “one size fits all” approach as perpetuated in the project management body of knowledge is the first deficiency I wished to address through this thesis. The project classification school of thought classifies projects into four types according to their level of clarity regarding goals and enablers. Figure 1 on page 20 presents a graphical depiction of the type of project addressed in this thesis. The intention to bring this type of project to a point of clarity at which goals and enablers are made clear is depicted by the arrow.

There are a variety of artefacts, principles and processes that are commonly associated with projects and their management. However, generally these appear not to reflect the lived experiences and realities of projects in a volatile, uncertain, complex and ambiguous (VUCA) environment. The reality of managing projects in real life is vastly different from what is presented in the literature with the known, theorised artefacts tending to distort the lived experience.

Van der Hoorn and Whitty (2014) elude to dominant project management dogmas that reinforce thinking that is not aligned with the “lived experience” of projects. Table 4 presents a summary of what project management artefacts veil, disclose, how they link to the dominant project management dogma, and the subsequent implications for practice. Expanding further on the work of Van der Hoorn and Whitty (2014), the implications of this dominant dogma, specifically for exploration projects, are shown in the last column below:

Table 4: Sign of dogma

Sign/artefact	The sign (and its referring entity) veils... "Lived experiences"	The sign (and its dominant project) discloses...	Link to the dominant project management dogma	Examples of the implications of the veiling	Implications for exploration projects
<b>Project (definition)</b>	Projects represent a response to a breakdown or unsatisfactory situation.  Project work cannot be clearly differentiated from other work.	Traditional definition of project management: finite piece of work, unique; and distinguishable from other types of work.	Simplification of project work  Systematisation of project work	We lack a contextualised understanding of what a project is and, therefore, we may have poorly aligned expectations of its nature (i.e. it can always be successful).	There is a lack of contextualisation, a lack of understanding of the problem, and general resistance to call a project a project when there are no clear objectives and skills.
<b>Project completion</b>	Projects are associated with a person's worth/value and, thus, the finite timeframe may invoke anxiety and grief for those involved.	A time when the work associated with the project will be finished and the work has been accepted.	Simplification of project work  Systematisation of project work	There is a personal and potentially emotional impact due to the temporary nature of project work.	Project leadership of exploration projects may be difficult if it is linked to ticking the right box and moving on to the next project. The factors of completion cannot be dictated from the beginning of the project because its foggy.
<b>Plans</b>	Projects are of emergent nature and, thus, forecasting/planning cannot be assumed to be an accurate reflection of what will occur.	Project work may be planned (accurately) and controlled; it has a predictable nature.	Simplification of project work  Faith in project management doctrine	Disappointment or dissatisfaction when project is not in accordance with s not track to plan or issues arise.	How is it possible to plan work that is emergent in nature from the beginning of the project?
<b>Gantt charts and work breakdown structures</b>	Projects as unpredictable and amorphous	Project work may be quantifiably defined, and sequenced. It can be treated similarly to production work.	Simplification of project work  Industriousness  Scientific management	Disappointment or dissatisfaction when project does not adhere to plan or issues arise	In a volatile work environment, the future is unpredictable, thus how does one accurately schedule tasks and responsibilities?
<b>Business case</b>	Potentially the real motivations (perhaps personal or not politically correct) for undertaking projects	A project is rationally motivated; it aligns with business objectives or strategy, or its benefits outweigh the costs	Frugality is valued  Work as rationalisable	Projects are assumed to always serve 'legitimate' business functions although they may also serve more covert personal agendas alternatively, needs (particularly where existing organisational operations cannot enable the agenda to be achieved).	Reasons for undertaking exploration projects cannot be linked to an established business case as the concept has yet to be prototyped and tested.

<b>Iron triangle</b>	The complexity of the project environment and managing a significant number of interrelated factors.	Project management may be understood in terms of managing scope/quality, cost and time.	Simplification of project work  Scientific management	Propagates a lack of understanding of the complexity of project work and, therefore, potentially limits new insights/ solutions that could be identified if a broader perspective were adopted.	Scope, cost time cannot be used to measure the success of an exploration project. The benefits of the project may be realised only after completion of the project.
<b>Project management best practice and method guides</b>	Each project requires a unique approach; and project management requires a diverse set of skills and tools (i.e. beyond the bodies of knowledge) and the knowledge of how to apply.	There is a 'best-way' to manage all projects.	Universal laws  Doctrinal supremacy of 'bodies of knowledge'  Faith in project management doctrine	Constrains thinking regarding other methods or tools that may be more effective in a given situation  Direct funds into sustaining these project management methods when funds may be better invested in alternative tools, techniques or training.	There is no best practice, method or guides to ensure the successful delivery of exploration projects. Nevertheless, harnessing the power of individual creativity and group thinking assists the project vision to emerge.

(Source: Adopted from Van der Hoorn & Whitty, 2014)

Generally, project management tools and techniques are based on a deterministic and reductionist approach, which is based on the linear cause-and-effect thinking that forms the basis of the traditional management concepts and scientific principles of management that emanated during the 19th century after the Industrial Revolution. In a mechanistic way, the scope of the project is determined and deconstructed into a work breakdown structure. This process is at the core of project management techniques. However, the challenge arises of how the scope may be broken down when there is ambiguity and uncertainty, and the stakeholders do not even know what they want. How does one plan the work and assign project teams in such circumstances? How does one choose a project methodology and best practice when the objectives and skills to implement are all unknown? In common with Van der Hoort and Whitty (2014), who propose the deconstruction of the project management body of knowledge to make it more practical, reflective of lived experiences and more conducive to building theory and practice, I propose a new thinking, new constructs, new terminology and new artefacts for the management of exploration projects as this would be more reflective of their uniqueness and complexity than is presently the case.

## 2.8 Research context: Exploratory sandpit projects

Project management is at the heart of every field and the problems associated with project management are universal. It was, therefore, imperative to choose a context for this thesis that would match the definition of the type of projects addressed in this thesis. In order to do this, it was necessary to understand both the field and the project management problems faced by researchers and practitioners in practice.

The field selected for the purposes of the study was the education field. This choice was largely influenced by my position as a researcher working in the educational sector, my passion for education and, discussed in Chapter 1 under the positionality of the researcher, both my leadership role and my project manager role in the educational technology space. The choice was also influenced by the authentic intervention I wished to accomplish as a researcher testing the project artistry design principles, which I had anticipated would emerge from the study. In addition, I had sought a field in which I would be able to have access to real-life settings in which the impact of the empirical research could be tested in an authentic, open environment while be able to work closely with practitioners in the field of study.

As a result of my experience in a higher educational institution I also realised that there was much complexity and uncertainty in this ever-evolving field. The ongoing, evolving, technological environment, in addition to the uncertainty related to teaching, educating, learning and pedagogical issues, tends to lead to crippled, sometimes aborted, educational projects or unrealised potential in projects and specifically in emerging economies.

I engaged with the education department at the University of Cape Town to enquire further about higher education problems in the context of emerging economies, specifically in South Africa and Africa. I read a number of papers from the *International Journal of Higher Education* in order to identify the challenges facing higher education in Africa. The next section discusses some of the findings relating to the challenges facing higher education in Africa.

### 2.8.1 Challenges facing higher education in Africa

There are numerous challenges facing higher education in Africa. This section summarises the challenges facing higher education that were relevant to this thesis.

#### 1. Use of ICTs for teaching

The South African government has identified the use of ICTs in teaching and learning as an important priority. For example, the policy on e-education states that:

Every South African manager, teacher and learner in the general and further education and training bands will be ICT capable (that is, use ICTs confidently and creatively to help develop the skills and knowledge they need as lifelong learners to achieve personal goals and to be full participants in the global community) by 2013 (Department of Education, 2004, p. 17).

Thus, the ultimate goal of the policy is the realisation of ICT-capable managers, educators and learners by 2013. Bozalek, Ng'ambi, and Gachago (2013) maintain this focus on teaching and learning, coupled with growth in educational technology in South African higher education institutions (Czerniewicz & Brown, 2005), requires that questions about the ways in which educational technology may contribute to addressing the educational challenges in the new South Africa be discussed and addressed.

#### 2. Diversity

As is the case in higher education globally, higher education in South Africa is under pressure to increase the participation of diverse groups of students in higher education and to produce the skills required for a rapidly changing society. In the United Kingdom, for example, participation in higher education has increased since the 1940s although the participation of higher socio-economic groups still exceeds that of lower socioeconomic groups (Department of Education report, 2004). While

similar, these challenges in South Africa assume particular forms given the country's unique history. For example, global disparities are defined in terms of class while, in South Africa, the educational disparities are manifested along racial lines due to the political, economic and social policies of the pre-1994 era. Thus, the redress of marginalised groups and social transformation were central to the policies of post-1994. The South African government has made it clear that one of its aims is to achieve equitable access to higher education for previously disadvantaged learners from diverse educational backgrounds (Hardman & Ng'ambi, 2003) with education being viewed as one of the key mechanisms for achieving social transformation.

### **3. Resource constraints**

Higher education in South Africa is currently facing the challenges posed by a diverse student population with varied levels of preparedness, multilingualism, large classes and the massification of education and is also under pressure to increase the throughput against a backdrop of limited resources (Jaffer, Ng'ambi, & Czerniewicz, 2007; Scott, Yeld, & Hendry, 2007).

### **4. Technology deployment projects**

In their paper on transforming teaching using emerging technologies, Bozalek et al. (2013) indicate that the integration of technology into the curriculum has been seen as another way of responding to the challenges faced but that this is often applied as an overly optimistic remedy resulting in large institutional infrastructure projects, such as the implementation of resource intensive institutional learning management systems (LMS) in all HEIs in South Africa (Ivala, 2011; Snyder & Prinsloo, 2007). Not all these projects have been consistently successful, although one of the reasons for failure may be that of unique contexts. Each environment, system, and processes are wired differently and there is a need to understand context and to conduct a thorough investigation into problems before deploying solutions. However, the education field is not geared to this and, thus, the tendency is to use the next available off-shelf solution in order to address local problems.



## 5. Problem-solving mind-set

One of the challenges facing education systems in general and higher educational institutions in particular is scaffolding the participants to develop a new mind-set that may be capable of generating new and innovative solutions to existing societal problems in their respective contexts (Makhoalibe & Ng'ambi, 2015). This challenge is compounded by the growing gulf between the theories taught in education and practice as experienced by practitioners. A case in point is the fact that, despite mobile devices in particular, mobile telephones are becoming increasingly pervasive as everyday tools in the hands of both educators and participants, there are only a handful of developers who are designing pedagogically effective applications aimed at addressing the local educational challenges.

## 6. Culture of creativity and innovation in education projects

In her book entitled *Teaching as a design science*, Laurillard (2012) laments the fact that although teaching is a design science like architecture, engineering or computer programming, as it shapes both “what is learned and how it is learned” (p. 8), the failure to view teaching as a design profession is resulting in creative and innovative pedagogical opportunities being lost. Thus, the pillars for cultivating a culture of creativity and innovativeness to design solutions that are locally relevant are also missing.

## 7. Contextualisation

One of the reasons for the failure of projects may be that of unique contexts. Each environment, system, and process is wired differently and it is, thus, important to understand context and to dig deeply into problems before deploying solutions. Although there may be legitimate reasons for this approach but it has proven both to miss the target and also to be ineffective in that that it is often not relevant.

The last few years have seen a renewed effort to close the “credibility gap” (Levin & O'Donnell, 1999)

in educational research. Some see this gap as arising from unscientific research approaches (e.g., NRC, 2002), while others point to the detachment of research from practice (Lagemann & Shulman, 1999). Educational research that is detached from practice may not account for the influence of contexts, the emergent and complex nature of outcomes, and the incompleteness of knowledge about which factors are relevant for prediction (Robinson, 1998).

## **8. Success of education projects**

Bozalek et al. (2013) maintain that claiming success for an educational intervention is problematic. If success means being certain that a particular intervention has resulted in learning, then there is a need to look carefully at the intervention in a particular setting. On the other hand, if success means being able to claim that an intervention may be effective in any setting, then we should study the effects of the intervention across a variety of settings in order to be able to generalise. However, this type of research leaves many questions unanswered as to how any observed learning may be said to have resulted from interactions between intervention and setting.

Although these problems are not the only challenges faced in the education field, they do relate specifically to projects in the education field within the African context. The next section discusses the emergence of the educational sandpit concept as a way of overcoming some of these challenges.

### **2.9 Emergence of educational sandpits**

In an effort to address these wicked problems in education, educational sandpits have emerged in the last decade. These were developed to encourage a culture of problem solving and also the development of contextually relevant solutions co-created by educators from varying backgrounds and disciplines.

This section explored the concept of an educational sandpit. The meaning of a sandpit is addressed first.

While writing this thesis I was sitting in a beach sandpit observing my toddlers, aged two and four, as they engaged with other children they had just met on the beach and played together in the sandpit, creating and co-creating, building and destroying, exploring and experimenting. I pondered on the concept of a sandpit and why it has emerged in the education field. What is the meaning behind an educational sandpit?

I then asked myself questions about the sandpit in order to uncover the basic meaning of a sandpit:

1. What?

The dictionary definition of the word “sandpit” is a “***shallow box or hollow in the ground, partly filled with sand for children to play in***”. (Sandpit, 2016)

This definition provided answers to my next questions:

2. Who? ***Children***

3. Where? ***Shallow box or hollow in the ground filled with sand***

4. When? ***Whenever***

5. How? ***Playing***

From the above I deduced that an educational sandpit would refer to a place filled with simple, day-to-day apparatus, inviting educators to unveil the *child in them* and play and experiment either for fun or for productivity.

In my research in the education field, I had encountered two different conceptions of educational sandpits in Africa – one focused on educational technology and the other on multidisciplinary research. There was a compelling reason for both conceptions, namely, to facilitate spaces and opportunities for African educators to collaborate, co-create and design their own context relevant, solutions to their problems. Both are grounded in well-established research in education by experts in the field who believe that the sandpit concept is capable of addressing some of the wicked problems encountered in education and mentioned above.

In 2014, the University of Cape Town launched the first educational technology sandpit in South Africa. This sandpit focuses on “*empowering educators to develop “home-grown solutions” to education using technology*” (The ETILAB sandpit 2014). The second sandpit devised was a programme developed by the African Science Leadership Programme (ASLP) which aimed at empowering mid-career, African academics in the areas of thought leadership, team management and research development and with the aim of enabling them to contribute to the development of a new paradigm for science in Africa, focused on the contribution of this new paradigm as solving the complex issues facing both Africa and the global community in the project context.

The common factor in both of these sandpit concepts is the ability to co-create, initiate, implement and manage highly complex, ambiguous, uncertain, educational projects by diverse teams.

Section 2.3 and section 2.4 below discuss the background to and the justification for these sandpit concepts.

### 2.9.1 Educational technology sandpit - Educational Technology Inquiry Lab (ETILAB)



Figure 5: Educational Technology Inquiry Laboratory participants

[Online image] Available from: <http://etilab.org/>

[Accessed 10/09/2014]

*“Education has problems. Technology has solutions looking for problems.  
The two should fit, and this conviction fuels the continuing  
interest in technology-enhanced learning”  
(Laurillard, 2008: 1)*

### 2.9.1.1 Background of the ETILAB

The shortcomings of educational technology projects are experienced in different way by various parties, in some instances, it is the successful implementation of an educational technology project but the failure to harness the project output and provide a return on investment. In another instance, it is the failure to meet the project objectives which were set and the faulty implementation of the project, thus eventually providing no benefit to the project sponsors. There are also cases of failure to define the specific objectives to be met in a technological implementation project while many projects are implemented haphazardly due to a lack of guidance and empowerment as regards using technology in the education context. Much has been written about educational technology and the benefits of technology in education; however, it would appear that many educational technology innovations are not benefiting all those who deploy them. This thesis corresponds with Huff's plenary closing remark at the project management conference that it is imperative that new mind-sets are developed in order to find new ways of working as embedded project practices tend to obscure and overlook strategically critical innovations in education (The ETILAB sandpit 2014).

For example, the ubiquitous nature of educational technology artefacts has rendered them very popular, especially in the developing world context in which technology is seen as both a powerful resource that brings access and reach to unreachable places but which is also capital intensive and unaffordable by many. Accordingly, the tendency is to adopt and customise solutions which were developed for different markets and in different contexts in order to meet local needs. This often leads to failure and frustration on the part of those using these customised solutions that do not speak directly to their specific needs. The high failure rate of educational technology projects, which are deemed crucial for both economic development and socio-economic empowerment, has far reaching

effects on education.

The problems in the educational technology space may be defined as “wicked”. Rittel and Webber (1973) define wicked tasks as difficult, messy, contradictory, aggressive and confounding tasks that are seemingly impossible to solve. This has also been observed in educational technology projects, which are often viewed as simple with many, thus, approaching them as simple projects. However, there are numerous contradictory considerations which should be borne in mind, such as whether technology makes pedagogy simple or more complicated, whether it lightens the educator’s load or exacerbates it and whether it removes the barriers between the educator and the learners or creates more barriers. There are ongoing debates about these wicked problems and the paradoxes that exist in the education and technology space. The complexity of these problems may be said to reside in the interdependencies as the field involves numerous stakeholders, factors, and decision makers who may have conflicting values.

There is an increased demand for a more purposeful, sense-making, engaging approach to educational technology projects, where implementations are not just for the sake of technology itself or to tick the boxes in the to-do list, but which, instead, represent mindful engagement between the educators who understand pedagogy, the technology specialists who understand infrastructure and leadership that facilitates an atmosphere which is conducive for both creativity and co-creation in order to ensure uniqueness in these projects.

One of the emerging ways of addressing these wicked problems in educational technology has been the creation of the “educational sandpit”. This sandpit is grounded on the principle of experiential learning and play spaces for educators. Based on the fact that emerging technologies have become ubiquitous and are continuing to evolve rapidly there is an increasing need for novel approaches to life-long and life-wide learning for educators. The potential for educators to learn through play is potentially effective for 21st century professional development. This concept simulates a real sandpit in which children play and which encourages imaginative and creative play in children. It also allows them to imagine, design and build several structures, smash what they are not happy with and start

again whenever they want to – all within a non-threatening environment (Ng’ambi, 2014). Failure is not perceived as a threat but is, instead, embraced as an opportunity to build something else or try out another design. Likewise, the educational 'sandpit' enables educators to learn without being taught, learn with devices, learn how to teach with devices, have fun while learning, build teaching models, test and 'throw-away' as in 'a sandpit' (Ng’ambi, 2014), and gain confidence while discovering the possibilities of tools and devices before introducing new practices into a 'live' classroom.

It is important to investigate statement made by the Department of Education in South Africa. Firstly, it refers to educators who are empowered and who use ICTs confidently and, secondly, the educator who is creative and harnesses this creativity to develop the skills and knowledge required to further the learning process and continually contribute to the global community.

The sandpit was developed to meet the expectation regarding expertise and yet to continually innovate in order to produce better educational technologies. The proposed model below demonstrated the processes that facilitate this and provides an overview of the activities which take place in the educational sandpit. The next section in the chapter elaborates on the problem definition phase of DBR while Chapter 3 elaborates on the identification of the “educator” as the main focal point in the field of educational technology. The sandpit concept allows the educator to identify a need that may met through technology, go through a creative process to clearly identify the need and, once the need has been clearly defined, conduct research into existing technology and how it may the need identified.

### 2.9.1.2 Educational technology sandpit projects

The degree to which technology fits may vary from fully meeting the need to not meeting it at all. The educators are then guided both on how to deploy the technology in the case of best-fit technology being found and on established PMBOK processes that may facilitate this process that requires the analysis and exploitation of existing solutions. On the other hand, in a case in which no technology meets the need, or existing technology meets some aspects of the need and not others, there would to

be a process involving the exploration of ideas. This requires a completely different set of design skills that would allow co-creation, empathy, creativity and rapid prototyping in order to redesign or design a solution. This then results in innovative educational technologies that may be used by other educators in the same predicament. However, this, creates a vicious cycle as the more educators are empowered to use technology to meet their pedagogical needs, the greater the demand to deploy more technology in their learning processes. This is depicted in the figure 8 below.

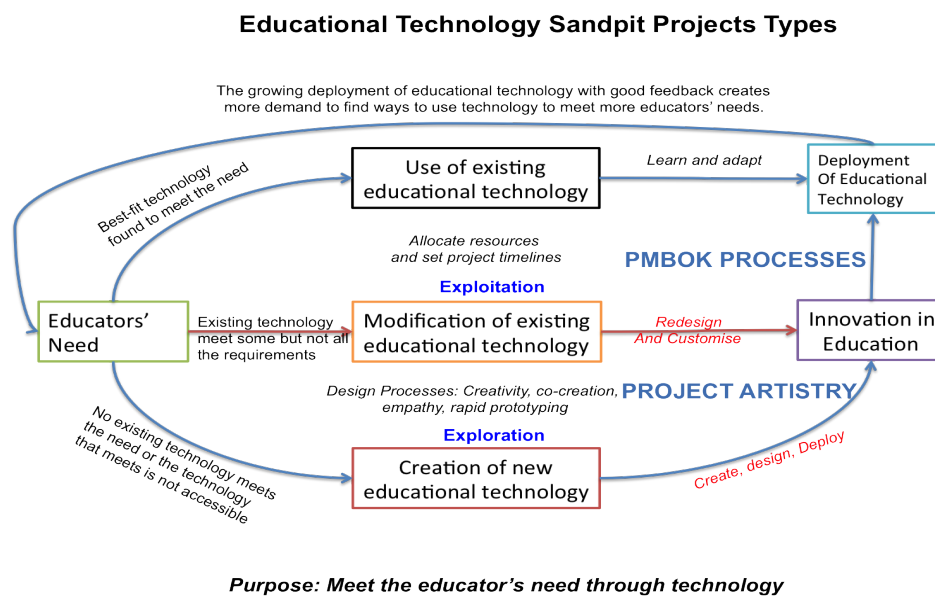


Figure 6: Deployment in educational technology sandpit

The sandpit aligns itself with the vision to empower the educator and create a space in which the educator is free to be creative and further develop knowledge and skills in a non-judgemental space. This growing phenomenon of a sandpit introduces an entirely new approach to educational technology projects as, at the core of the sandpit concept, is the notion of play and creativity in order to encourage innovation in educational technology. On the other hand, there are researchers (Robinson, 2008; Thompson & Thompson, 2007) who maintain that creativity, questioning and laughter decline as people age. Thus, this is a paradox with a space for play and creativity being designed for adults whose creativity is declining with age. Accordingly, it becomes important that this space reignites the innate creativity in individuals and facilitates this in teams to ensure co-creation



and innovative output in educational technology.

### 2.10.2 Multidisciplinary sandpits



Figure 7: Sandpit creation

#### 2.10.2.1 Introduction

A sandpit in the research context is an intensive, interactive workshop designed to produce radically innovative research proposals. Participants from a diverse range of disciplines come together in a creative, free-thinking environment – away from their everyday routines and responsibilities – and immerse themselves deeply in a collaborative process involving an important challenge.

The first conception of the multidisciplinary sandpit was an event which was intended to inspire more innovative and *multi-disciplinary* research proposals. This sandpit was conceived by the Engineering and Physical Sciences Research Council (PERC) in 2003 (Dugan, 2011). Sandpits are described as residential interactive workshops involving 20 to 30 participants from multidisciplinary fields. Sandpits involve a highly multidisciplinary mix of participants, often some active researchers and others potential users of research outcomes, in order to drive lateral thinking and radical approaches with which to address research challenges. Thus, sandpits are led by a director with a group of stakeholders and subject experts working as mentors to provide support. The group of subject experts is not eligible to receive research funding so the members act as impartial referees in the process.

Sandpits are intensive discussion forums where free thinking is encouraged in order to probe into the problems on the agenda and uncover innovative solutions. Each sandpit is led by a director who defines the topic and facilitates discussions at the event.

The development of the African multidisciplinary sandpit followed a preparatory workshop which included the University of Pretoria (UP), Global Young Academy (GYA), Leopold Leadership Programme (LLP), Collective Leadership Institute and Know Innovation (KI).

#### **2.10.2.2 Multidisciplinary sandpit projects**

Similar to the educational sandpit project, multidisciplinary sandpit projects also start from a place of unclear objectives and means. Although there are academics from diverse backgrounds that come together to co-create multidisciplinary research present, everyone is unclear of what may emerge from this collaboration and they have to accept and follow guidance through a process that facilitates the individual creativity, openness and collaboration that will lead to greater clarity on emerging multidisciplinary projects.

### **2.10 Justification of context: Exploratory sandpit projects as exploration projects**

The emergence of educational sandpits to address educational challenges was driven by the need to transform educators into problem solvers, afford them the opportunity to collaborate and co-create solutions, and allow them the space and environment in which they could come up with innovative, original solutions relevant to their own unique contexts. However, the challenge is that, unless the sandpits are guided by well-established design principles that are facilitated to encourage an environment that nourishes creativity, co-creation and confidence, the above-mentioned problems will not be solved in the sandpit environment.

It was mentioned at the beginning of this chapter that the education field and, in particular, the

sandpit environment was specifically chosen as a research context to test in this thesis. Thus, it was deemed necessary to justify this choice by highlighting the similarity between educational sandpit projects and the exploration projects addressed in this thesis and then to suggest how project artistry design principles could apply to educational sandpit projects.

#### Similarities between exploration projects and educational sandpit projects

The educational sandpits described above demonstrate common factors that distinguish the projects conceived and developed in these spaces differently from the usual educational projects. The table below presents these common factors together with the projects and exploration projects that were referred to in this thesis.

*Table 5: Comparison of exploration projects with educational sandpits projects*

Characteristics	Exploration projects	Educational sandpit projects
Clarity on project objectives	Unclear	Unclear
Means to achieve or execute projects	Not known	Not known
Emergent	Yes	Yes
Require diverse teams	Yes	Yes
Characterised by high levels of ambiguity and uncertainty	Yes	Yes
Objectives and means are generated through co-creation	Yes	Yes
Experimentation	Yes	Yes

The table above highlights that educational sandpit projects possess all the characteristics of exploration projects, which demonstrate a high level of ambiguity and uncertainty. Figure 9 below depicts the stance of such projects and the quest to bring them to a place of clear objectives and enablers.

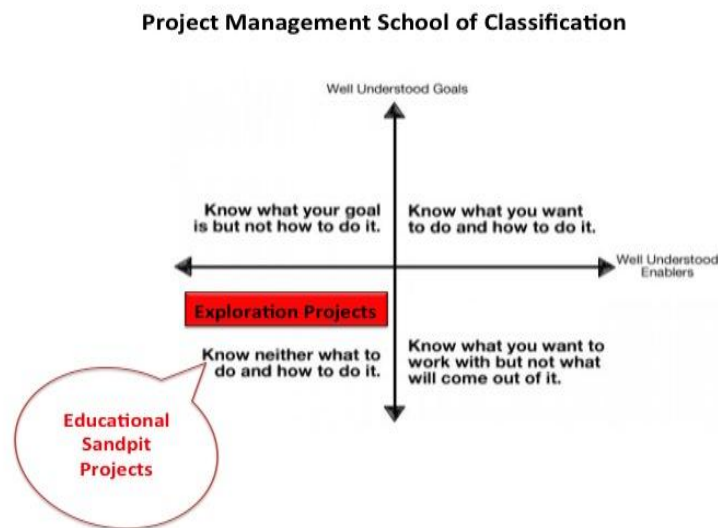


Figure 8: Educational sandpit projects as exploration projects

## 2.11 Chapter 2 summary

This chapter discussed the knowledge gap identified in project management, specifically in the management of educational sandpits. Although the project management body of knowledge is diversifying, the gap still exists on implementation of projects with high levels of ambiguity and uncertainty. The operational environment is considered to be increasingly volatile, uncertain, complex and ambiguous as are the projects which are implemented in this environment. This thesis focused specifically on the education field where the concept of the sandpit was devised in an effort to address the wicked problems that exist in this space. The primary role of the sandpit is to conceive and deliver innovative projects that offer contextually relevant solutions formulated by diverse teams. It was pointed out that such projects share the same characteristics as exploration projects, which always start from a place of unclear or unknown objectives and means to achieve these objectives. These projects informed the context of this study. The next chapter discusses the development of a framework that may be used to bring clarity to the objectives and means characteristic of such projects.

## Chapter 3: Framework Development and Research Paradigm

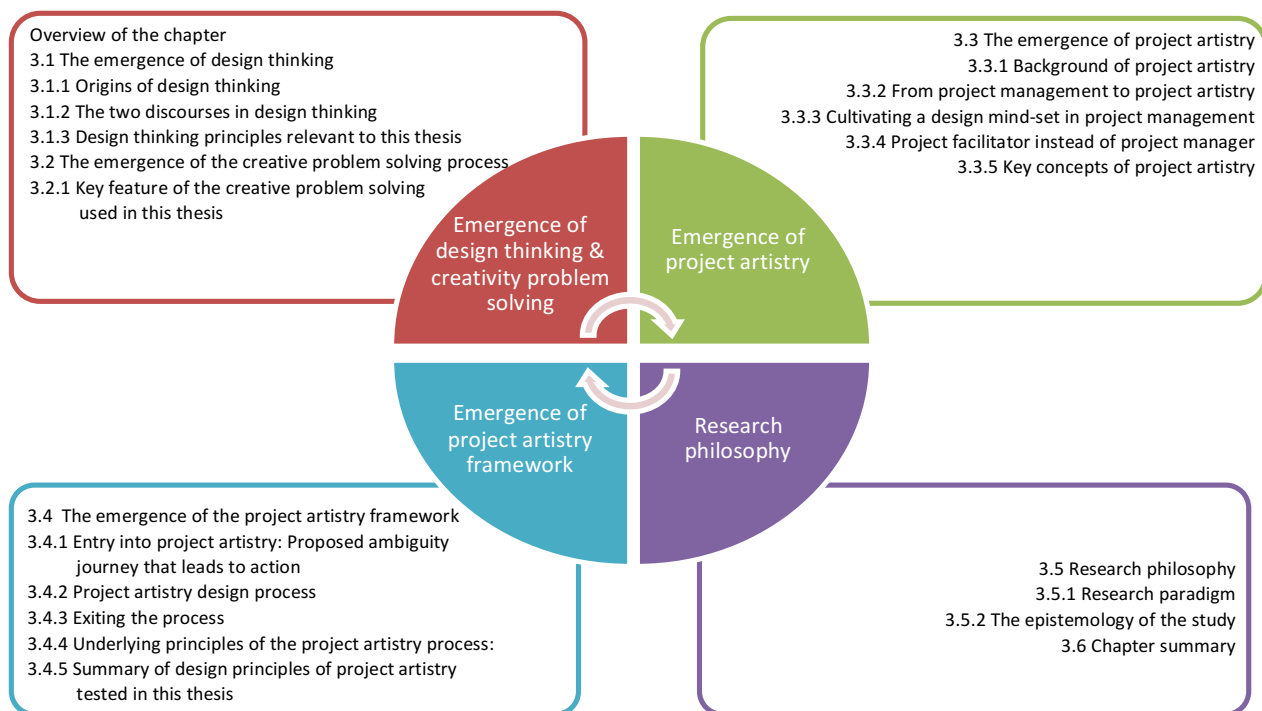
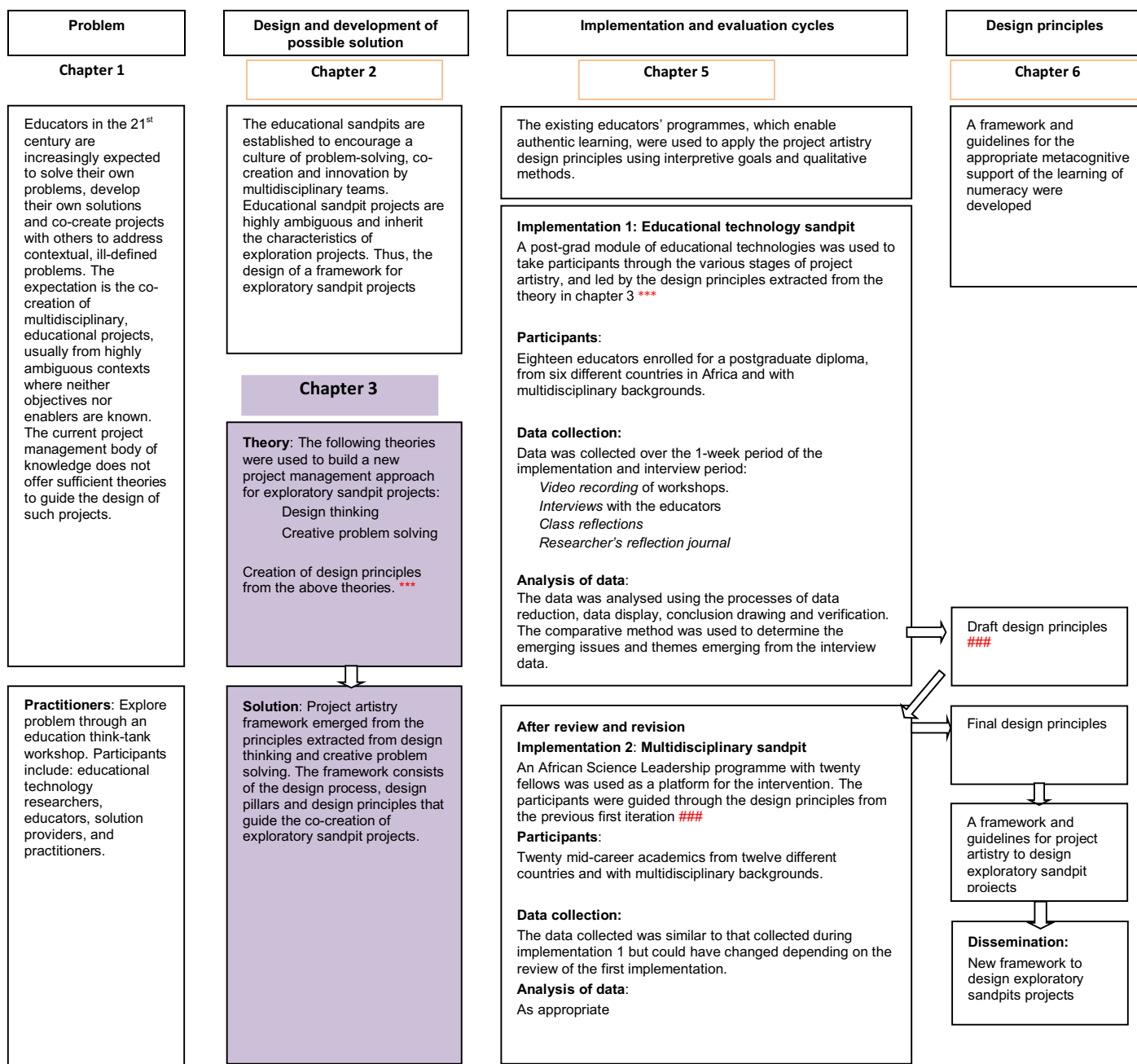


Figure 9: Overview of Chapter 3

## Chapter 3 – Framework Development and Research Paradigm highlighted in the context of this study



(Adapted from Reeves (2006, p. 59)

## Overview of the chapter

This chapter discusses the development of the framework proposed in this thesis as a model that may be used to manage exploratory sandpit projects. The model is based on the foundations of design thinking (DT) and creative problem solving (CPS) design principles. The first section explores the emergence of design thinking, which is considered to include the principles, frameworks, processes and mind-sets that cultivate creativity and co-creation in groups. The next section focuses on the core principles of creative problem solving – a phenomenon established sixty years ago and based on the belief that everyone is creative, and deliberate creativity may be practised in groups in order to generate innovative projects. The third section 3 explains the emergence of project artistry and the basic details of project artistry emerges in order to provide a broad perspective on the DT and CPS principles that influence the project artistry framework. This leads to a discussion on the project artistry framework, which is built on these core principles. This section then describes the emerging design principles that will be enhanced by the design-based methodology adopted in this thesis. The chapter ends with a discussion of the research paradigm that informed the study. Chapter 3 attempts to address research sub-questions 1 and 2 which focus on the way in which design principles may be extracted for the design thinking phenomenon to contribute to the building of framework for exploratory sandpit projects. The last sub-question focuses on the creative problem-solving phenomenon that may inform the emerging framework.

### 3.1 The emergence of design thinking

In his book, *The design of business*, Roger Martin (2009) opens the chapter on design thinking with the phrase “How thinking like a designer can create sustainable advantage”. This incorporates the essence of the way in which he defines “design thinking” in terms of its individual components, namely, the “designer” and the way he/she “thinks”.

The Oxford Dictionary defines a designer as “a person who plans the look or workings of something prior to its being made, by preparing drawings or plans”. It also defines thinking as “the process of considering or reasoning about something”. Based on these meanings, design thinking may therefore



be defined as a process of reasoning undertaken by a person who plans the characteristics of an artefact prior to its being made.

Figure 12 below represents a screen shot taken in February 2015 and showing that a Google search of “design thinking” retrieved 17.6 million results. It is intriguing to note that that the very first search result went to management discourse. Design thinking is an emerging field of study. There are numerous diverse meanings of design thinking, depending on the contexts according to which various individuals embody the concept and then describe it. The past decade has witnessed the increasing popularity of design thinking, especially in management studies and in practice. Business leaders and managers have adapted design thinking as a part of their companies’ innovation processes with the business community giving a new flavour to the term.

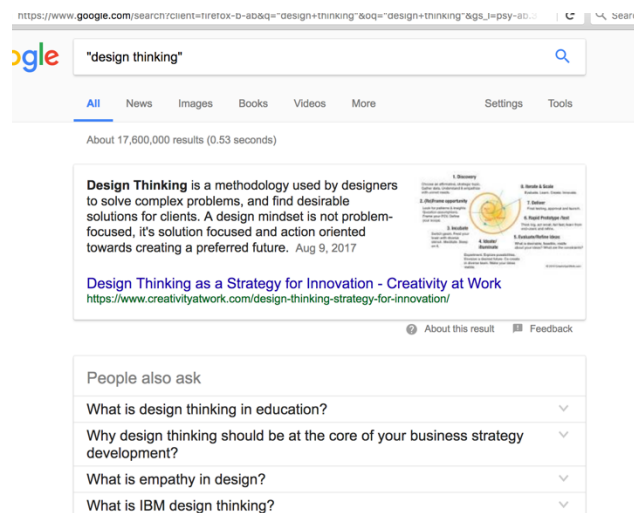


Figure 10: Google results for “design thinking”

Design thinking has become a widely-discussed phenomenon in both business and design-related media. It was, therefore, vital to establish the meaning of design thinking in the context of this thesis and to base this meaning within the existing body of knowledge and also to uncover theoretical grounds for the meaning in academia. Although the aim of the research was not to interrogate the meaning and validity of the design thinking phenomenon, it was, nevertheless, deemed important to expend sufficient effort in interrogating the foundations of the phenomenon, to align the definition within the context of existing literature and to establish its plausibility within this thesis. There are

many studies that have interrogated and questioned design thinking, with some writers regarding it as a contemporary phenomenon and an object of study. Such studies shed light on the ongoing debates on the design-thinking phenomenon. However, this thesis sought to ascertain the origins of design thinking, to argue its relevance in the management community and then to propose the practical application of design thinking in exploration projects.

### 3.1.1 Origins of design thinking

The term “design thinking” is considered to be confusing, with ongoing debates on the exact meaning of the term and how, if at all, it differs from, for example, creativity, innovation or systems thinking (Kimbell & Street, 2009). On the one hand, design thinking is often seen as a remarkable phenomenon in its own right and it has, for example, been described as a “powerful, effective, and broadly accessible” approach to innovation, “that can be integrated into all aspects of business and society, and that individuals and teams can use to generate breakthrough ideas that are implemented and therefore have an impact” (Brown, 2009, p. 3), or as “the next competitive advantage” (Martin, 2009). Extensive statements accompany the online declarations of what design thinking is able to achieve, for example, “great innovators and leaders need to be great design thinkers” and “design thinking is a catalyst for innovation and bringing new things into the world” (Plattner, Meinel, & Leifer, 2011). Papers making such claims are also infiltrating academia, for example, “design thinking as a catalyst of innovation” (Makhoalibe & Ngambi, 2014).

On the other hand, there is still significant doubt about the validity and novelty of the concept. Some researchers disregard it as entirely non-existent, while others view it as nothing new, for example, Norman (2010) maintained that design thinking is a public relations term for good, old-fashioned creative thinking. In the interviews, she conducted with three design thinking experts, Hanttu (2013) found there was no coherence in the meaning of design thinking and there were contradictions and confusions in the perception of the term. She concluded in her study that “I am not convinced the design thinking will become its own discipline for creating innovation; more likely it is to be forgotten when another trend or fad comes around, that providing something new and suitable for the present

economical moment" (p. 64).

Although I agree with the notion that there is no coherence in the meaning of design thinking, and while there is confusion in perceptions of the term, I do not agree that design thinking is just a fashionable, passing fad. On the contrary, I consider that a depth of understanding and the correct application of some of the founding principles of design thinking have the potential to generate innovation and change in business.

*"I recall having a conversation with a leading academic at the project management institute conference, who stated that 'design thinking is a fad and I do not believe it will add any value to the project management body of knowledge'. Interesting enough, the next project management EURAM conference in June 2015 included the theme 'Innovation, design thinking and project organising.'"*

Design thinking continues to be popular as a management discipline with many writers suggesting that it may add significant value to innovation and management. Design thinking is also gaining increased attention in businesses, organisations and even in business schools.

The title of the 2014 business conference at the University of Cape Town Graduate School of Business was "Design Thinking for Social Innovation". This title revealed the extent to which design thinking is gaining momentum, even in South Africa. In 2014 Cape Town, South Africa was declared as the World Design Capital. This not only helped to increase the popularity of the design industry but events, talks, and articles on design thinking as a management phenomenon in various settings in South Africa proliferated.

In an article on the University of Cape Town *Newsline* by Richard Perez (2014), the Chief Executive of World Design Capital in South Africa and which has done considerable in the City of Cape Town with design thinking, stated "[d]esign thinking may sound abstract but it's not sitting in a chair thinking of solving problems. It is doing something, helping you to come up with ideas, prototype them, test and reflect on them" (para. 5). This suggests that design thinking is about enacting, doing and performance

rather than theory.

According to Perez (2014), design thinking provides a framework and process structure which ensure greater success and more effective implementation as there is more engagement with the end users. He further stated that "[the focus on design-led thinking as a methodology should be seen as a tool; a technique to help people think like designers around the challenges they are facing – whether in the private or public sector, within budgets or existing systems" (para. 7).

In the same article, it was reported in an interview with the chairman of the Design Thinking Conference at the 2014 UCT Graduate School of Business, Kosheek Sewchurran that design thinking deals with emergence rather than a conclusive phenomenon – "It is also about allowing for the solution to emerge, rather than defining a solution upfront. Design thinking includes a co-creation process which can be used to imagine and create almost anything. That makes it quite powerful" Sewchurran (para, 9).

The South African Design Indaba website defines design thinking as "methods and processes used for thinking differently about ill-defined problems and finding more effective and sustainable solutions than those that currently exist" (para. 1).

Nevertheless, despite the rising interest in design thinking, especially in management studies, there is still no single conceptualisation or a clear-cut understanding of the design-thinking concept (Hassi & Laakso, 2011). Thus, in order to evaluate the claims cited above and further develop the understanding of design thinking, its use, application, benefits and limitations, a shared understanding and conceptualisation of the concept are needed. This thesis proposed design thinking as a driver for innovation in exploration projects and, hence, a level of depth is required in the understanding of the concept and its origins in order to establish strong theoretical grounding for the claims made in the thesis.

It was, therefore, deemed crucial to study the origins of design thinking and to trace the founding

principles of the phenomenon according to literature. It is already clear from the meaning of design thinking that it has its origins in the design industry and was then adopted by management studies in an effort to understand the way in which designers solve “wicked” problems. Thus, it was necessary to study and document the design thinking process in terms of the detail to which it may be applicable to managers handling the same level of wickedness in their day to day activities.

The next section expands on these theoretical grounds.

### 3.1.2 The two discourses in design thinking

The two discourses in design thinking are discussed in this section. Reference is made to the research already conducted by Hassi and Laakso (2011) on the origins of the phenomenon and dating as far back as the 1960s and then its adoption into management studies in the early 21<sup>st</sup> century by David Kelly (2001) at which point became popular as a management phenomenon. It continues to be studied in the work of Cross (2001) in the design field. The diagram below (Figure 12) illustrates the two discourses.

## Roots of design thinking: views from the two discourses

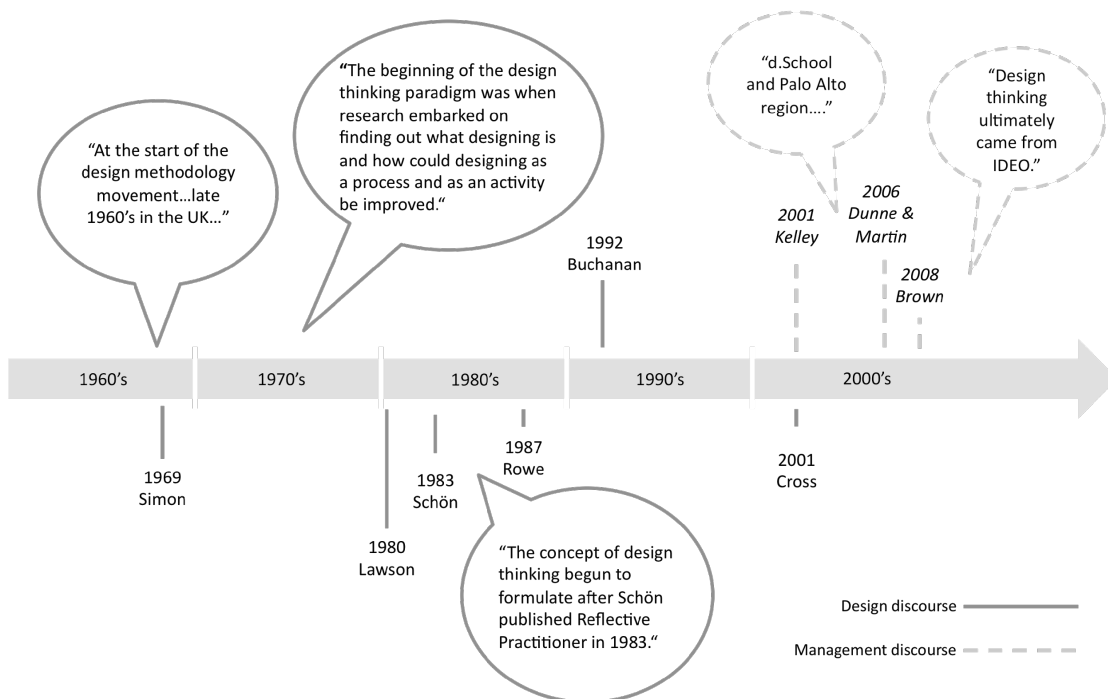


Figure 11: Emergence of design thinking: Views from the design and management discourses according to Hassi and Laasko (2011)

Lassi and Laasko (2011) conducted a study on design thinking in the design discourse and in the management discourse. Their findings are summarised in Figure 12 above. In their invaluable work they were able to map out the origins of design thinking in design studies. They suggested that design thinking had first been regarded as a design methodology in the late 1960s while, in the early 1970s, it came to be seen as a process that could, potentially, be improved. Design thinking in the early 1980s saw a more formal integration with Schön's (1983) publication of the *Reflective practitioner*. The research is continuing with the work of Cross (2001).

For the purpose of this thesis, the focus was on the management discourse on design thinking as the focus of the thesis was project management. Hassi and Laasko (2011) devised a three-dimensional framework for explaining the management view of design thinking. The dimensions indicated in the framework include thinking styles, practices and mentalities. The practices comprise elements that are closely related to concrete activities and describe tangible approaches, ways of working, activities

and the use of particular tools. The thinking style refers to issues such as cognitive styles, methods of thinking and processing information while mentalities refer to the mentality of both the individuals immersed in the work and the mentality portrayed in the organisational culture.

*Table 6 Three-dimensional frameworks explicating the common elements of design thinking as depicted in the management discourse*

PRACTICES	THINKING STYLES	MENTALITY
<ul style="list-style-type: none"> <li>• <b>HUMAN-CENTERED APPROACH</b> E.g. People-based, user-centered, empathizing, ethnography, observation (e.g. Brown 2008; Holloway 2009; Ward et al. 2009)</li> <li>• <b>THINKING BY DOING</b> E.g. Early and fast prototyping, fast learning, rapid iterative development cycles (e.g. Boland &amp; Collopy 2004; Lockwood 2010; Rylander 2009)</li> <li>• <b>VISUALIZING</b> E.g. Visual approach, visualizing intangibles, visual thinking (e.g. Carr et al. 2010; Drews 2009; Ward et al. 2009)</li> <li>• <b>COMBINATION OF DIVERGENT AND CONVERGENT APPROACHES</b> E.g. Ideation, pattern finding, creating multiple alternatives, (e.g. Boland &amp; Collopy 2004; Drews 2009; Sato et al. 2010)</li> <li>• <b>COLLABORATIVE WORK STYLE</b> E.g. Multidisciplinary collaboration, involving many stakeholders, interdisciplinary teams (e.g. Dunne &amp; Martin 2006; Gloppen 2009; Sato et al. 2010)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>ABDUCTIVE REASONING</b> E.g. The logic of “what could be”, finding new opportunities, urge to create something new, challenge the norm (e.g. Fraser 2009; Lockwood 2009; Martin 2009)</li> <li>• <b>REFLECTIVE REFRAMING</b> E.g. Rephrasing the problem, going beyond what is obvious to see what lies behind the problem, challenge the given problem (e.g. Boland &amp; Collopy 2004; Drews 2009; Zaccai in Lockwood 2010)</li> <li>• <b>HOLISTIC VIEW</b> E.g. Systems thinking, 360 degree view on the issue (e.g. Dunne &amp; Martin 2006; Fraser 2009; Sato 2009)</li> <li>• <b>INTEGRATIVE THINKING</b> E.g. Harmonious balance, creative resolution of tension, finding balance between validity and reliability (e.g. Brown 2008; Fraser 2009; Martin 2010)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>EXPERIMENTAL &amp; EXPLORATIVE</b> E.g. The license to explore possibilities, risking failure, failing fast (e.g. Brown 2008; Fraser 2007; Holloway 2009)</li> <li>• <b>AMBIGUITY TOLERANT</b> E.g. Allowing for ambiguity, tolerance for ambiguity, comfortable with ambiguity, liquid and open process (e.g. Boland &amp; Collopy 2004; Cooper et al. 2009; Dew 2007)</li> <li>• <b>OPTIMISTIC</b> E.g. Viewing constraints as positive, optimism attitude, enjoying problem solving (e.g. Brown 2008; Fraser 2007; Gloppen 2009)</li> <li>• <b>FUTURE-ORIENTED</b> E.g. Orientation towards the future, vision vs. status quo, intuition as a driving force (e.g. Drews 2009; Junginger 2007; Martin 2009)</li> </ul>

(Source: Hassi & Laakso, 2011)

Table 6 presents the constituent elements that fall into each category, an example of each dimension and theoretical referencing which includes the author and year of publication. Hassi and Laakso (2011) suggested that further development of their framework and the possible operationalisation of the concept would enhance a more systematic and explicitly acknowledged integration of design thinking into organisations than was the case at the time.

The term design thinking started to appear in general discussion in business and management related media during the past decade. Business publications such as the Harvard Business Review, Fast Company and Bloomberg's Business Week began to publish articles and online blog posts about design thinking and how it could help companies to add value to the products and services they were offering to their customers. In the business and management realm, the term design thinking is associated with the creation of organisational and other intangible innovation such as service innovation. The design thinking process is based on the methods and tools which designers use in their profession when designing. When the term began to appear in business and management related media, design thinking was often presented as something novel and revolutionary, thus creating excitement around it. Against this background, the following design thinking concepts were used in the thesis in the construction of a framework in terms of which to manage exploration projects.

### 3.1.3 Design thinking principles relevant to this thesis

#### I. Design thinking process

There are several design thinking models which have been conceptualised by various writers as described in the previous section. Brown's (2008) design thinking model depicted in Figure 13 below outlines each step of the design thinking process, starting with identifying the users, learning more about them during the empathy phase and defining, conceptualising, ultimately, prototyping the solution until an artefact is developed and tested during the testing phase (see Figure 13). This thesis draws upon these principles. The arrows imply the iterative nature of the process, the ability to revisit any stage and re-defining, re-thinking and modifying the outcome.



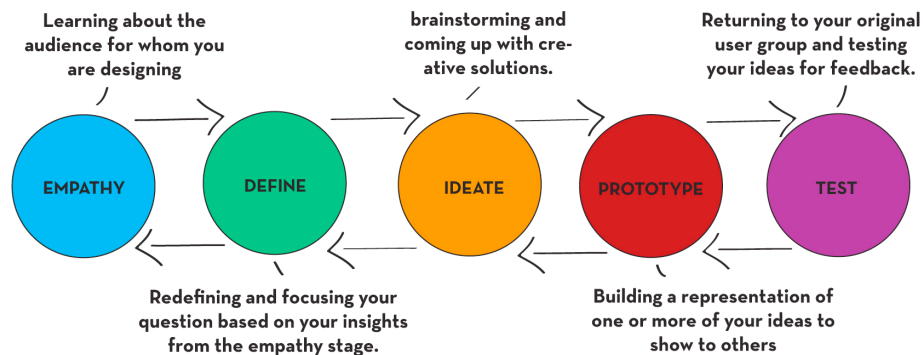


Figure 12: Design thinking process (Brown, 2008).

[Online image] Available from <http://createdu.org/design-thinking/>

[Accessed 09/09/2014]

## II. Design thinking is different from traditional thinking

Akoakoa (2012) defines the difference between traditional thinking and design thinking in Table 7 below.

Table 7: Difference between traditional thinking and design thinking

Traditional Thinking	Design Thinking
<ul style="list-style-type: none"> <li>• What is the right answer?</li> <li>• Repeatable, proven processes               <ul style="list-style-type: none"> <li>• Design For</li> <li>• Think for insight                   <ul style="list-style-type: none"> <li>• More talk</li> </ul> </li> <li>• Stuck inside                   <ul style="list-style-type: none"> <li>• Data</li> <li>• Events</li> </ul> </li> <li>• Talk about facts                   <ul style="list-style-type: none"> <li>• Siloed</li> </ul> </li> </ul> </li> <li>• Evolutionary (bored)</li> </ul>	<ul style="list-style-type: none"> <li>• What is the <b>right question</b>?</li> <li>• <b>Intuitive</b>, responsive practice</li> <li>• <b>Design With</b></li> <li>• <b>Build</b> for insight</li> <li>• More <b>listen</b></li> <li>• Get <b>outside</b></li> <li>• <b>Stories</b></li> <li>• <b>Experiences</b></li> <li>• Talk about <b>feelings</b></li> <li>• <b>Collaborative</b></li> <li>• Revolutionary (<b>inspired</b>)</li> </ul>

(Source: Akoakoa, 2012)

### III. Empathy

“In the realm of design, design-thinking is rooted in empathy, where you try to see from the perspective of a user of a given design or product. There is a lot more to design thinking than that but, in a nutshell, it is about human-centred design where empathy is king” (Weinlick, 2012). Design theorists as well as practitioners describe empathy as a crucial impact factor in design thinking (e.g. Brown, 2008; Kolko, 2011; Kouprie & Visser, 2009). The empathy is defined as walking in another’s shoes and feeling their pains closely before designing a solution for them. Brown (2010) says design thinking can identify an aspect of human behaviour and then convert it into both a customer benefit and a business value.

Design thinking principles of empathy encourage the use of observation, gaining insights and seeking a deep human understanding of what customers want. This entails seeking to walk in their shoes, validating assumptions, asking penetrating questions, deep listening, connecting emotionally, and demonstrating empathy towards customers. This process is different from carrying out a project requirements process, interviewing stakeholders or conducting project focus groups or surveys and, instead, it comprises insightful observation, living in the customers’ world, experiencing their perspective, and seeking to co-create with them in designing and delivering what they need. Ironically, projects rely on classic scope definition and requirements gathering processes that are often static, cursory and rely heavily on documentation (Duggal, 2010). Design thinking takes into account that it is often difficult for people to articulate what they want and, hence, project artistry proposes that the project team observes, engages and empathises with people in order to gain insights and facilitate their see their problem(s) through different lenses.

Inherent in the process of seeing the world from another’s perspective is the ability to empower the users to feel part of the problem-solving situation to a point where they do not feel a divide between the problem-solving agents and themselves. This is because the project is conducted in such a way that the users are part of the problem-solving process, they are part of the project team and they contribute everything they know about the project. This leads to the next point on experimentation.

#### IV. Experimentation

There are several definitions of design thinking that capture the theme of experimentation mentioned below:

- \* “Design Thinking is a human-centric, holistic approach to problem solving and business thinking that employs empathy, ideation, prototyping and experimentation to solve real-world issues” (Moottee, 2013)
- \* “Rapid Prototyping expresses a new concept in a tangible form for exploration, testing, and refinement” (Liedtka, 2014).
- \* “Prototyping and experimentation produced conversations with real customers, a better source of information than PowerPoint presentations to colleagues in conference rooms. And all of this market-based learning generated forward momentum and energy for the project” (Liedtka, 2014).
- \* Brown and Wyatt (2010) explained design thinking as a methodology for problem solving that aids interdisciplinary team members to create a “vibrant interaction environment that promotes iterative learning cycles driven by rapid conceptual prototyping” (Leifer & Steinert, 2011, p. 151).
- \* “Design thinking is a user-centred, rapid prototyping approach to innovation” (Kelley, 2011).

One of the key features of design thinking is the project artistry that embraces the ability to reach the place of a tangible prototype rapidly in order to have develop a feel for and experience and interact with the artefact, thereby providing a quick response and suggestions on developments. The co-creation process emphasised above allows the user to be part of this creation process and, hence, to own the solution and test it from the perspective that it is their own creation as they have participated

in the co-creation process.

## V. Co-creation and creativity

Several authors place emphasis on the co-creation with users and unleashing creativity in designing with users. Design thinking is a mind-set and a skill. It is an expression of creative intelligence that can be learned. Several authors suggest that design thinking is a process that encourages co-creation with emphasis on creativity. The following quoted from several articles and books elaborate this:

- \* “Seeking that sweet spot of feasibility, viability, and desirability as you take into account the real needs and desires of your customers is part of what we at IDEO and the d.school call ‘design thinking’. It’s our process for **creativity** and innovation” (Kelly & Kelly, 2013).
- \* “Design Thinking draws upon logic, **imagination**, intuition, and systemic reasoning to explore possibilities of what could be, and to create desired outcomes that benefit the end user (the customer). A design mind-set is not problem-focused, it’s solution focused, and action oriented. It involves both analysis and imagination” (Nayman, 2015).
- \* “Design Thinking attempts to inspire the essential element of **creativity**, the ability to take an abstract idea and create something with it” (Cohen, 2014).

## VI. Diversity

“Design thinking’s collaborative methodology and tools help teams to actively leverage their differences in positive ways” (Liedtka, 2014). “The highest payoff from adopting a design-thinking approach was not necessarily in identifying a solution, but rather in innovating how people worked together to envision and implement the new possibilities they discovered” (Liedtka, 2014).

Radical collaboration brings together innovators from varied backgrounds and with different viewpoints and enables breakthrough insights and solutions to emerge from the diversity. Brown and

Wyatt (2010) explained design thinking as a methodology to problem solving that aids interdisciplinary team members to create a “vibrant interaction environment that promotes iterative learning cycles driven by rapid conceptual prototyping” (Leifer & Steinert, 2011, p. 151).

## VII. Exploration and exploitation

According to Martin (2010), ambidexterity refers to the ability to use both the left brain and right brain in problem solving. He maintained that it is essential that organisations learn to embrace the analytical mind as much as the intuitive or creative mind. Figure 15 below presents a graphical depiction of this 50/50 mix and which is referred to as design thinking.

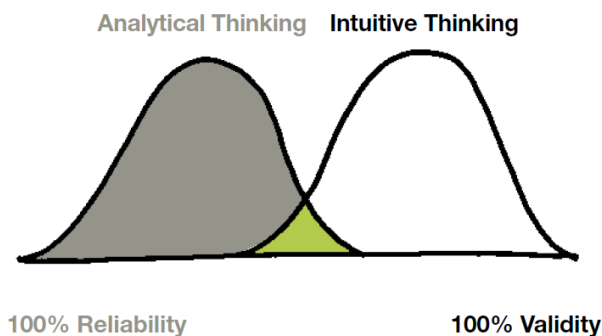


Figure 13: Design thinking: 50/50 mix between analytical and intuitive thinking. (Martin, 2010)

(Available from: <https://designthinkingedu.wordpress.com/2014/06/15/engineering-design-vs-design-thinking/>

[Accessed 10/09/2014]

Martin (2010) says that, in the future, the most successful businesses will balance analytical mastery and intuitive originality and this dynamic interplay he calls design thinking. Unlike traditional analytical thinking, design thinking’s open-ended abductive approach to problems enables social innovators and change makers to take creative leaps to ideas generation and the realms of possibilities. “The answer is not to try to get corporations to embrace intuitive thinking at the expense of analytical thinking or vice versa. Rather it lies in a third form of thinking – design thinking – that helps a company both hone and refine within the existing knowledge stage and generate the leap from stage to stage, continuously” (Martin, 2010).

## VIII. "Glue between the disciplines"

Design Thinking works horizontally across an organisation to tear down silos, improve communications, and deliver new insights. It allows organisations to explore new possibilities and engage diverse teams. It has been called "the search for a magical balance between business and art; structure and chaos; intuition and logic; concept and execution; playfulness and formality; and control and empowerment. Cohen (2014) calls it "the glue between disciplines".

### 3.2 The emergence of the creative problem solving (CPS) process

Creative problem solving (CPS) was developed by Alex Osborn and Sid Parnes in the 1950s, and nurtured at the SUNY Buffalo State and the Creative Education Foundation. In his breakthrough work, *Applied imagination*, Osborn revealed Hindu teachers had been using brainstorming for over 400 years and that Walt Disney encouraged it among his artists in the 1920s. Osborn formalised the creative problem-solving tool in the 40s.

CPS is a proven method for approaching a problem or a challenge in an imaginative and innovative way (Osborn, 1953). It helps people to redefine the problems and opportunities they face, devise new, innovative responses and solutions, and then take action. The tools and techniques used make the process fun, engaging, and collaborative. CPS not only helps in the creation of better solutions but it also creates a positive experience that helps to speed up the adoption of new ideas. Figure 16 below shows the four basic steps of CPS.

***"The most direct way to develop creativity is by practicing creativity...by actually thinking up solutions to specific problems" (Alex F. Osborn, 1953).***

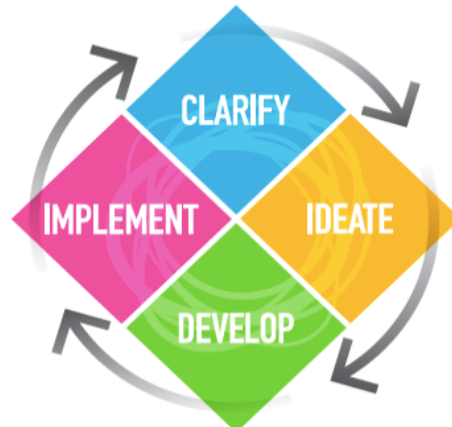


Figure 14: The creative problem-solving process

[Online image] Available from: <http://www.creativeeducationfoundation.org/>

[Accessed 10/09/2014]

CPS educator and practitioner, Ruth Noller, PhD, described CPS as the sum of its parts:

**Creative** specifies elements of newness, innovation, and novelty.

**Problem** refers to any situation that presents a challenge, offers an opportunity, or represents a troubling concern.

**Solving** means devising ways to answer, to meet, or to satisfy a situation by changing either the self or the situation.

*Ruth Noller also created a symbolic equation for creative problem solving:*

$$C = fa(K,I,E)$$

*Creativity is, thus, the function of combining knowledge, imagination, and evaluation, all of which are tempered by attitude. Fostering a positive belief that each person is creative is the key to engaging knowledge, imagination, and evaluation.*

**Source:** Creative Education Foundation Resource Guide (2015). Accessed at:

<http://www.creativeeducationfoundation.org/wp-content/uploads/2015/06/CPS-Guide-6-3-web.pdf>

In an effort to come to a better understanding of the multi-faceted phenomenon known as creativity, Rhodes (1961) set out to formulate a universal definition of creativity. He believed that, as regards the definition of creativity, “when analysed, as through a prism, the content of the definitions form four strands” (p. 307). These four strands to which Rhodes refers include person, product, process and press.

Osborn (1953) introduced the structure of Creative Problem Solving (CPS) as a method for solving problems creatively. The first CPS process depicted three distinct stages, namely, fact finding, idea finding and solution finding. The concepts of deferred judgement and quantity yielding quality were also explored in research. The concepts of imaginative and judicial thinking were used to demonstrate that people engage in both these types of thinking. The fundamental beliefs set forth by Osborn prompted those who followed to continue to research and develop the CPS process.

Over the course of the past sixty years, many researchers and developers have presented a variety of creative problem-solving models and approaches. Work on these presentations has taken place in numerous different settings, including colleges and universities, public elementary and secondary schools, small and large businesses, and numerous consulting organisations. The various stages are summarised in Table 8 below.

*Table 8: An overview of various versions of Creative Problem Solving Process.*

Major Version	Issue or Need	Outcome or Result
1 (1942-1967)	The need for an explicit or defined creative process	The initial Creative Problem Solving model and preliminary guidelines and tools for generating ideas
2 (1963-1988)	The need for a validated instructional programme to intentionally develop creative talents	The Creative Studies Project and published CPS instructional materials
3 (1981-1986)	The need to address individual differences and situational issues when learning and applying CPS	The 5 O's of Mess Finding (Orientation, Outlook, Ownership, Outcomes and Obstacles) and improved balance between diverging and converging thinking
4 (1987-1992)	The need to respond to key findings from impact research	The development and clustering of three main CPS process components



5 (1990-1994)	The need to respond to developments in cognitive science and stylistic differences in viewing CPS	A neutral and descriptive style in the approach to CPS and the introduction of task appraisal
6 (1994-Present)	The need for a systemic way to use the results from appraising a task, and then designing an approach to process	The integration of people, context, and desired results into the CPS framework and the introduction of accessible language to describe the system

(Source: Isaksen & Treffinger (1987))

Osborn's Applied Imagination (1953, 1957) popularised his description of CPS and also the term brainstorming – now arguably the most widely known and used (and too frequently, misused) term associated with creativity.

Osborn continued to study creativity and to apply his process strategies and techniques in both his advertising work and his teaching. In the revised edition of Applied Imagination, Osborn (1963) condensed his original seven stages into three more comprehensive stages, namely, fact finding, idea finding and solution finding.

The continuous improvement in CPS is reflected in a number of ways. Today's CPS framework has drawn upon its heritage by refining and clarifying the vocabulary or language used for processing, identifying and elaborating on the relationships between all the elements in the CPS system, and by providing and elaborating on a broad array of tools in order to incorporate into the more extensive framework than before. The current efforts are maintaining and expanding the long commitment to making CPS explicit, teachable, and repeatable.

### 3.2.1 Key feature of the creative problem solving used in this thesis

CPS begins with two assumptions:

- ❖ **Everyone is creative.**
- ❖ **Creative skills may be learned and enhanced.**

(CEF Resource Guide, 2015)

The key themes emerging from the studies on creativity and creative problem solving are summarized below:

### 1. Ambiguity acceptance

Hagen & Park (2013) suggest that people who have tolerance for ambiguity and uncertainty portray leadership styles that promote innovative, adaptive, and entrepreneurial behaviours. Isaksen (1985) mentions that Participants often become involved in CPS activities with which they may not be familiar but they remain open to the generation of novel and unusual perspectives. In order to do this, they must tolerate the ambiguity, which might accompany the use of certain CPS principles and techniques.

### 2. Applied imagination

*“Exercise your imagination! The more creative you become, the more you will get out of life”*

*(Alex Osborn, 1952).*

*“Imagination is more important than knowledge. For while knowledge defines all we currently know and understand, imagination points to all we might yet discover and create”*

*(Albert Einstein).*

Osborn studied creative people in order to identify the natural process in terms of which they created good ideas. With the goal of approaching problems with greater imagination, he incorporated his learning into the first versions of the CPS process, helping people learn how to be more deliberately creative.

(CEF Resource Guide, 2015)

### 3. Problems are opportunities to apply CPS

A fundamental principle in the creative problem-solving school is seeing problems as a source of new

products, markets and opportunities. Although this does not happen naturally, this way of seeing problems will lead to new opportunities to solve these problems in creative, imaginative ways and, hence, the term “creative problem solving”.

#### **4. Deferred judgement**

According to the principle of deferred judgement, while exploring the possible solutions to a problem, you first diverge with your thinking and then you converge with it. This involves two separate stages as it is possible to do one at a time only. To diverge means to ask "Why?" and "What if?" After finishing diverging you converge. To converge means to ask "How?" and "What is needed?" In other words, zoom out and then zoom in. (CEF Resource Guide, 2015)

#### **5. Questioning**

Creative problem solving involves a process of asking progressive questions. It is, thus, a matter of asking the right questions at the right time in order to move the process forward. In order to be more creative in problem solving it is essential to learn the questions to be asked and the proper sequence of these questions. In addition, when asking it is vital to listen without judgement. (CEF Resource Guide, 2015)

Isaksen, Dorval, and Treffinger (1996) further revised the CPS framework by describing it in terms of three distinct components and six stages. The three components were known as “Understanding the Problem, Generating Ideas and Planning for Action” (p. 60). In addition, they also introduced the step involving task appraisal. Isaksen et al. (1994) argued that “to get the most from using CPS it is necessary to understand the people who are involved; the situation or context within which the challenge or concern is located; and, the task upon which CPS will be used” (p. 137).

Questions must be asked, as questions. Solutions are more readily elicited and developed when challenges and problems are restated as open-ended questions with multiple possibilities. Open-

ended questions generate much rich information while closed-ended questions tend to elicit either confirmation or denial while statements tend to generate either a limited or else no response at all.

## 6. Divergent and convergent thinking must be balanced

Learning ways in which to identify and balance expanding and contracting thinking (done separately) and knowing when to practise them such thinking is key to creativity. Judgement must be either deferred or suspended (CEF Resource Guide, 2015). As Osborn learnt in his early work on brainstorming, instantaneous judgement in response to an idea shuts down idea generation. There is an appropriate and necessary time to apply judgement when converging thinking is used.

Prior versions of CPS had described rules for divergent thinking (Noller, 1977; Parnes et al., 1977). Isaksen and Treffinger (1985) strengthened the concept of “dynamic balance.” They believed that “in CPS, the core is to learn to use effective methods for generating and evaluating ideas, and try to accomplish a reasonable balance between ‘diverging’ and ‘converging’, creating the ‘dynamic balance’ that makes CPS powerful and productive”. The CEF resource guide offers the guidelines for divergent and convergent thinking depicted in the Figure 16 below.

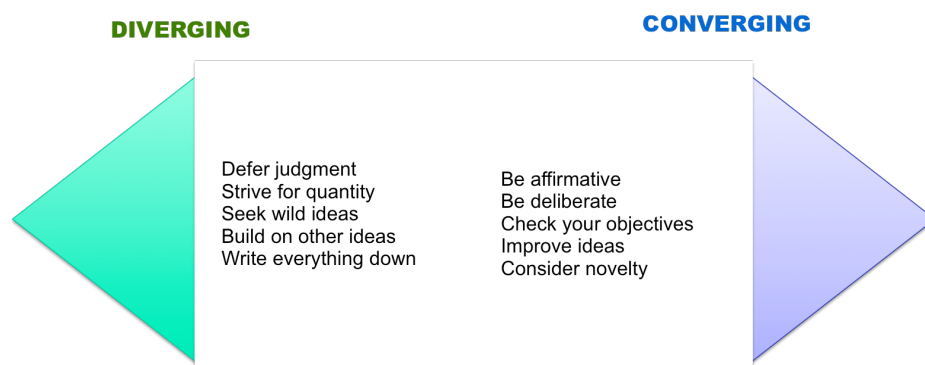


Figure 15: Guidelines for diverging and converging thinking

## 7. Rules are tools

Rules are tools and they should not become barriers. All rules were created to make life easier for

someone at some point in time. However, all rules should be questioned because conditions change and the rule may no longer apply. It is necessary to ask "Why?" to discover the root of the rule and it may be time to change, amend or remove an outdated rule.

The following key elements support deliberate creativity and creative thinking, namely, the choice to:

- Shift from "Yes, but" to "Yes, and" thinking
- Foster a "What if?" outlook (remaining curious)
- Suspend or defer judgements to maintain an openness to new ideas
- Recognise that every experience informs creativity
- Embrace incubation and allowing the brain to work "out of awareness" on ideas
- Develop a climate for creativity by changing the physical environment or mental/emotional outlook to be open to new ideas
- Use creative problem-solving tools in order to hone practice
- Work ideas instead of using them (allowing them to change and develop)
- Balance the use of imagination, knowledge and evaluation
- Develop an internal, observing "wise self."

*(CEF Resource Guide, 2015)*

## **8. Creative language:** *Focus on "Yes, and ..." rather than "No, but."*

Language matters in the generation of information and ideas. "Yes, and" allows the continuation and expansion which is necessary in certain stages of CPS. On the other hand, the use of the word "but" – whether preceded by "yes" or "no" – closes down conversation, negating everything that has come before.

## **3.3 The emergence of project artistry**

### **3.3.1 Background of project artistry**

Artistry is defined as “creative skill or ability” (Artistry, 2016). The concept of project artistry emerged in the project management body of knowledge through the work of Duggal (2008). He described project artistry as a concept that is specifically relevant for dynamic, ambiguous, non-linear, complex and emergent (DANCE) projects that require more artistry than analysis and management for successful delivery. My criticism of Duggal’s work is that it is one-dimensional and refers to one article of design thinking only to highlight a few face value principles of design thinking but without uncovering the depth, strengths and weaknesses of design thinking.

In the context of this thesis, I proposed project artistry, which incorporates the principles of design thinking, and creative problem solving into a process, framework and facilitation tool that may be used in exploration projects. Based on the design concepts of design thinking and creative problem solving I wished to challenge the existing project management dogma and propose certain core design principles that would encourage co-creation, ambidexterity, creativity, empathy and a user-centric approach to facilitate the successful delivery of exploration projects.

Traditional project management is related to setting clear goals, allocating resources, assigning tasks and monitoring progress in order to reach the desired end goal as depicted in Figure 17 below.

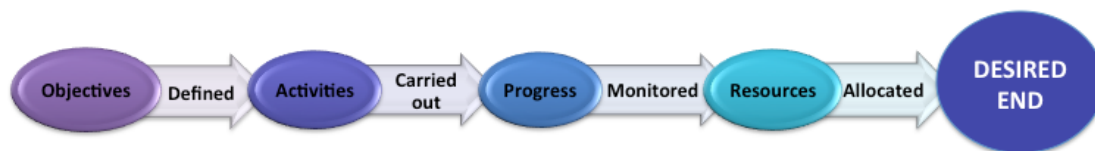


Figure 16: Simplistic project management approach

However, in the absence of clear goals and enablers, how does one begin to plan that which is unknown? Project managers are often tempted to work with vague objectives for the sake of putting in place a plan and working toward something when, in fact, there is an opportunity to reflect on designing and co-creating the project vision. Figure 18 below presents a detailed analysis of the

process project managers follow in order to solve problems.

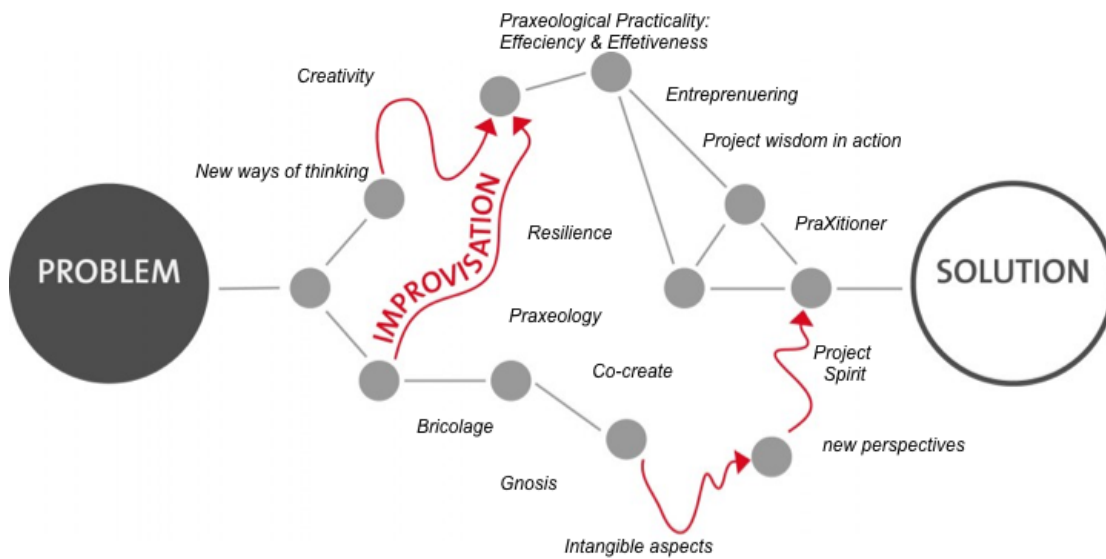


Figure 17: Ambiguity and complexity in project management

In place of trying to draw up a list of tasks, reflecting on the design aspects may assist by providing the project team with an opportunity to co-create a compelling vision for the project through facilitating an environment in which to do so. However, this approach requires cultivating a design mind-set and applying the abovementioned principles of design thinking and creative problem solving. This requires the willingness to let go of the confidence that comes with certainty, the unreal pretence of knowing all about the project on the part of the project manager, the letting go of known processes and methodologies for managing projects and, instead, cultivating the design mind-set. This will enable a fresh perspective on every aspect of the project, thus creating new and diverse perspectives on the matter and enable a clear understanding of the problem or opportunity in question. In other words, the letting go of existing project management dogmas results in new insights through design thinking and CPS processes. In order to cultivate this mind-set, I proposed the relinquishing of the old concepts regarding the six dogmas of project management and the gaining of new insights and terminology when managing exploration projects. A holistic approach to the project management of exploration projects requires the ability to exploit known facts while, at the same time, embracing imagination and future possibilities to create solutions that will be relevant in the future – see Figure 19 in page 98.

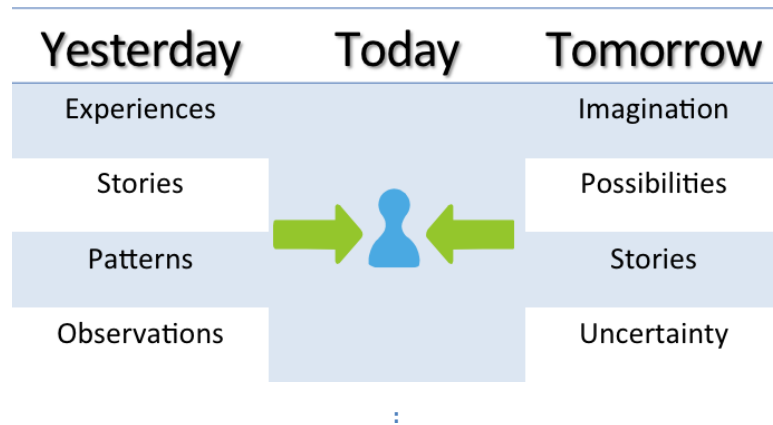


Figure 18: Holistic project management approach

### 3.3.2 From project management to project artistry

In the pursuit of building a project management body of knowledge that empowers project managers and project teams with the capabilities to manage in uncertainty, be comfortable with exploration projects and operate effectively in VUCA environments, I proposed letting go of some of the existing project management dogmas and redesigning the project management landscape specifically for exploration projects.

This work facilitates the emergence of project teams where individual creativity is tapped and a co-creation of project vision, project ideas and project concepts emerge through a design process that enabled both innovation and user engagement.

### 3.3.3 Cultivating a design mind-set in project management

*"Every human being is an artist ... called to participate in transforming and reshaping the conditions, thinking and structures that shape and condition our lives"*  
(Joseph Beuys, German artist).

It is a fact that exploration projects are characterised by unknown goals and unknown means with which to achieve these goals. Therefore, instead of planning these projects require a design. It would appear that plans based on sequential tasks and dependencies are not valid in a non-linear, changing, and unpredictable project reality. In fact, relying on the plan in such situations may become a risk.



A common response to managing projects in ambiguous circumstances is to rely on risk management. While risk management may mitigate some of the impact, it actually only helps in the case of known and unknown risks being identified and in which uncertainty may be quantified. It is important to understand the distinguishing factors between planning and design in order to understand the need for design in the interests of improving the way in which exploration projects are addressed.

## Planning versus design

Table 9: Key points of distinction between planning and design (Duggal 2010)

Planning	Design
Engineering approach – spells out the details and provides a mechanism to execute the vision	Architecture approach – provides form, function, and structure to ensure the feasibility and viability required to enable the vision
Focus on tasks and activities	Focus on interfaces – linkages and dependencies
Focus on what needs to be done	Focus on why it needs to be done
Geared toward deliverables and outputs	Geared toward experience and outcomes
Hierarchical organization	Visual and contextual organisation
Emphasis on delivering scope and specifications	Emphasis on achieving customer and end-user satisfaction
Reductionist breakdown approach	Holistic, integrative approach
Convergent and analytical process	Divergent and creative process
Constraints as limitations	Constraints as opportunities
© J. Duggal 2010	

Table 9 summarises the key distinctions between planning and design. While the plan spells out the details, the design provides the form, function, and structure required to organise the project or programme. Instead of investing considerable effort in the plan, which is bound to change, it may be more effective to focus on design. A sound design may enable a better withstanding of the dynamic

nature of the project and be better suited to deal with the exploration projects. Whereas plans try to avoid or fight uncertainty, design leans and thrives on it. Design uses an architecture approach – providing form, function and structure to ensure the feasibility and viability needed to enable the vision of the project or programme. Rushing into planning without design resembles detailing the engineering blueprints of a building without thinking about architecture, and resulting in an unstable structure. Instead of the detailed specifications, the design approach focuses on the structural interfaces, linkages and dependencies. Design is based on a holistic, integrative approach as opposed to a reductionist, breakdown basis of planning, thus resulting in a broader perspective which allows the exploration to be accommodated.

### 3.3.4 Project facilitator instead of project manager

*“Who is the Man, the Artist? He is the unspoiled core of everyman before he is choked by schooling, training, conditioning until the artist shrivels up and is forgotten. ... And yet that core is never killed completely. At times it responds to Nature, to beauty, to Life, suddenly aware again of being in the presence of a Mystery that baffles understanding and which only has to be glimpsed to renew our spirit and to make us feel that life is a supreme gift”*  
*(Frederick Franck, Author, Zen of seeing: Seeing/drawing as meditation)*

The dogma of the “project manager” impacts negatively on the project management body of knowledge because of the perception that a project manager is a one-stop contact who possesses all the information about the details of a project and is expected to deliver, control and report, and ensure the successful delivery of the project objectives. However, the assumption that this individual is equipped with the resources and techniques that will empower him/her to lead and guide, manage and control, and report and document until project completion is unrealistic in a VUCA world in which change is a certainty and the original thinking about a project is continuously challenged by the emerging realities of the new world.

I expanded further on this concept by proposing that exploration projects do not require a manager. By nature, these projects are characterised by unclear requirements and unclear methods. Hence, I argue that there is nothing to manage in this context. Facilitating a process of co-creating a project vision leading to the ideation and conceptualisation of a project is what is required toward clarity of

project requirements.

It may be argued that this role is a strategic role that must be integrated into the strategic project management role or business analysis space. However, I advocate strongly that this concept of project facilitation should permeate the project management body of knowledge to allow the cyclic, iterative nature of project to move from certainty back to the place of uncertainty which results from the volatility of the operational environment of projects. The following characteristics of project facilitators empower those leading in uncertainty to confidently guide the project team and help the team to navigate uncharted territories. At the same time, they will gain the trust of the project sponsors and ensure that the emerging project realities are being well explored and exploited so that there is room for innovation and new thinking.

Project artists know how to see and, hence, they are open to learning. In addition, they are open to multiple perspectives and they look for the non-obvious. Project artists focus on the right things and are skilled in the art of seeing. Project artists think design and use design thinking to design the project for maximum benefit and the intended outcomes within the given constraints and boundaries. This provides a greater opportunity to understand and focus on what the customers and key stakeholders require and to design a plan accordingly. Project artists improvise and iterate. They design the project with a creative eye and with a built-in flexibility that enables the project plan to be rearranged based on the emerging stakeholder needs (Duggal, 2008).

Project artists are comfortable with project environments that are dynamic and changing, ambiguous and uncertain, non-linear and unpredictable, complex and emergent. In order to manage exploration projects an organic approach is required. Project artists cultivate the skills required to sense, respond, adapt and adjust. Instead of using precisely defined rules and processes each time, project artists sense the situation and respond accordingly. For example, project artists plan but they do not become complacent about their plans and they continue to ask penetrating questions and challenge assumptions throughout the project lifecycle. Plans should be fluid and enabling and not rigid and confining. Rigid plans in an exploration project environment may result in blind spots that prevent

you from seeing the unfolding project reality while fluid plans enable you to sense and be open to emerging stakeholder needs and to respond to unexpected changes.

### 3.3.5 Key concepts of project artistry

Design thinking was conceived in the late sixties in design studies as a study of the way in which designers work and deal with complexity in their environment. Brown (2008) then introduced design thinking into management studies as a new mind-set was required in management and product development to ensure quality, novelty and business viability. Martin (2008) defines design thinking as the dynamic interplay between exploration and exploitation in order to harness past successes while enabling imagination, intuition and abductive reasoning to tap into future markets. Such a management approach has at its core empathy and rapid prototyping with iterations that involve the users in every phase of the project management, thus allowing the creative integration of user input and the experts in order to ensure feasibility, reliability and viability in the project concerned. There is no single definition of design thinking and, hence, this thesis draws from the diverse definitions of academics and practitioners so as to create a cohesive meaning for design thinking in the context of the study.

The dynamic interplay between of exploitation and exploration facilitated by design thinking should encourage both analytical and intuitive reasoning in project teams and, thus, generate novelty in exploration projects. Through the use of thematic analysis, I was able to develop what I call the design thinking alphabet or the ABC of design thinking. This represents twenty-six constructs of design thinking emerging from academics, practitioners and online materials defining design thinking

The table below defined the themes that emerged in the study. They were extracted from the literature on design thinking and creative problem solving and contained in academic papers, blogs, journals, books and other sources. For each theme, there is a quote and the source literature, then its relationship with the project artistry design principle; there it is related to people, process or the pillar of the process.

Table 10: Scholarly definitions of project artistry emerging from the key literature review

	Project artistry theme	Quote and author	Sources	Principle relating to people/process/pillar
A	Ambiguity Tolerance	Isaksen (1985) mentions that Participants often become involved in creative problem solving activities (CPS) with which they may not be familiar but they remain open to the generation of novel and unusual perspectives. In order to do this, they must tolerate the ambiguity, which might accompany the use of certain CPS principles and techniques.	Isaksen (1985)	People
B	Brainstorming	<p><b>"Design thinking</b> holds valuable clues as to how to get <b>bigger ideas, faster and more efficiently</b>" (Martin &amp; Christensen, 2013).</p> <p>"Involve design thinkers at the very start of the innovation process, before any direction has been set. Design thinking will help you explore more ideas more quickly than you could otherwise." (Brown, 2010)</p>	Turning Design thinking into design doing by Heather Fraser (2013)	Pillar
C	Creativity and co creation	<p>"Seeking that sweet spot of feasibility, viability, and desirability as you take into account the real needs and desires of your customers is part of what we at IDEO and the d.school call <b>"design thinking."</b> It's our process for <b>creativity and innovation.</b>" (Kelly &amp; Kelly, 2013)</p> <p>Design thinking is a mind-set and a skill. It is an expression of creative intelligence that may be learned.</p> <p>"Creativity is of major importance to <b>design thinking</b>, as it is to science thinking and thinking in any field." (Owen, 2007).</p> <p><b>"Design thinking draws upon logic, imagination, intuition, and systemic reasoning</b> to explore possibilities of what could be, and to create desired outcomes that benefit the end user (the customer). A design mind-set is not problem-focused, it's solution focused, and action oriented. It</p>	<p>Creative confidence (Kelly &amp; Kelly, 2013)</p> <p><a href="http://www.creativityatwork.com/design-thinking-strategy-for-innovation/">http://www.creativityatwork.com/design-thinking-strategy-for-innovation/</a></p> <p><a href="http://www.forbes.com/sites/reuvencohen/2014/03/31/design-thinking-a-unified-framework-for-innovation/">http://www.forbes.com/sites/reuvencohen/2014/03/31/design-thinking-a-unified-framework-for-innovation/</a></p>	People

		involves both analysis and imagination” (Nayman, 2016).  “Design thinking attempts to inspire the essential element of creativity, the ability to take an abstract idea and create something with it” (Cohen, 2014).		
D	Diverse teams	<p>“<b>Design thinking’s</b> collaborative methodology and tools help teams to <b>actively leverage their differences in positive ways</b>” (Liedtka, 2014).</p> <p>“The highest payoff from adopting a <b>design-thinking</b> approach was not necessarily in identifying a solution, but rather in <b>innovating how people worked together to envision and implement the new possibilities they discovered</b>” (Liedtka, 2014).</p> <p>Radical collaboration: <b>Bring together innovators with varied backgrounds and viewpoints. Enable breakthrough insights and solutions to emerge from the diversity</b></p> <p>Brown and Wyatt (2010) explained <b>design thinking</b> as a methodology to problem solving that aids <b>interdisciplinary team members</b> to create a “<b>vibrant interaction environment that promotes iterative learning cycles driven by rapid conceptual prototyping</b>” (Leifer &amp; Steinert, 2011, p. 151).</p>	<p>Liedtka (2014)</p> <p>Leifer &amp; Steinert (2011)</p> <p>Brown &amp; Wyatt (2010)</p>	People
E	Empathy	<p>“In the realm of design, <b>design-thinking is rooted in empathy</b>, where you try to see from the perspective of a user of a given design or product. There is a lot more to design thinking than that but, in a nutshell, it is about human-centred design where empathy is king”. (Weinlick, 2013).</p> <p>“Design theorists as well as practitioners describe <b>empathy as a crucial impact factor of Design Thinking</b> (Brown, 2008; Carlgren, 2013)</p> <p>“<b>Design thinking can identify</b> an aspect of human behaviour and then convert it into both a customer benefit and a business value” (Brown, 2009).</p>	<p><a href="http://thinkjarcollective.com/articles/empathy-in-creativity-and-design-thinking/">http://thinkjarcollective.com/articles/empathy-in-creativity-and-design-thinking/</a></p>	People
F	Future-	“Orientation towards the future, vision vs. status quo,	Hassi & Laakso	Process

	thinking	intuition as a driving force” (Drews, 2009; Martin, 2009)	(2011)	
<b>G</b>	Glue between disciplines	“Design Thinking works horizontally across an organisation to tear down silos, improve communications, and deliver new insights. It’s been called “the search for a magical balance between business and art; structure and chaos; intuition and logic; concept and execution; playfulness and formality; and control and empowerment. It’s been called <i>“the glue between disciplines”</i> (Oosterom, 2014).	<a href="http://www.designthinkingnetwork.com/video/design-thinking-is-glue-between-disciplines">http://www.designthinkingnetwork.com/video/design-thinking-is-glue-between-disciplines</a>	<b>People</b>
<b>H</b>	Human-centric	<p>“Design thinking is <b>humanising and human-centred</b>. Empathy is a core principle of design thinking. Design requires an understanding of the need and experience people are seeking to fulfil and how people will interact with whatever we are designing. ‘Being on the ground’ and observing the sociological dynamics are fundamental to the design practice” (Lui, 2014).</p> <p>Design Thinking is <b>Human-Centric</b>. It always focused on the customer or end user’s needs, including unarticulated, unmet, and unknown needs (Moottee, 2013).</p> <p>“Design thinking is a <b>human-centered approach</b> to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success” (Brown, 2009).</p>	<a href="http://designthinking-sydney.com.au/design-thinkingsydney/news/design-thinking-social-change">http://designthinking-sydney.com.au/design-thinkingsydney/news/design-thinking-social-change</a>  <a href="https://www.ideo.com/about/#WbwTtOZEow4s0EoF.99">https://www.ideo.com/about/#WbwTtOZEow4s0EoF.99</a>	
<b>I</b>	Innovation	<p>“Organisations can harness the power of design thinking to drive <b>true innovation</b>” (Martin &amp; Christensen, 2013).</p> <p>“When design principles are applied to strategy and innovation the success rate for innovation dramatically improves. Design thinking is at the core of effective strategy development and organisational change. Design can be applied to products, services, processes, physical locations... anything that needs to be optimised for human interaction. <b>You can design the way you lead, manage, create and</b></p>	<p>“Turning design thinking into design doing” Fraser (2013).</p> <p><a href="http://www.creativityatwork.com/design-thinking-strategy-for-innovation/">http://www.creativityatwork.com/design-thinking-strategy-for-innovation/</a></p> <p>Brown (2010)</p>	<b>Pillar</b>

		<p><b>innovate</b>" (Nayman, 2016).</p> <p>"Human-centered design thinking – especially when it includes research based on direct observation – will capture unexpected insights and <b>produce innovation</b> that more precisely reflects what consumers want" (Brown, 2009).</p> <p>"Design thinking" – a human-centered, prototype-driven process for <b>innovation</b> that can be applied to product, service, and business design" (Cohen, 2014).</p>		
<b>J</b>	Judgement on and off	<p>"The principle of <b>deferred judgement</b> states that, while exploring the possible solutions to a problem, first you diverge with your thinking and then you converge. Two separate stages. You can only do one at a time" (CEF Resource Guide, 2015).</p>	CEF Resource Guide (2015).	<b>Pillar</b>
<b>K</b>	Knowledge	<p>"Design thinking enables leaders to innovate along the path of the <b>knowledge funnel</b>, and the firms that master it can gain long-term business advantage" Martin (2010).</p> <p>"Design thinking empowers the design of business, the directed movement of a business through <b>the knowledge funnel</b> from mystery to heuristic to algorithm and then the utilisation of the resulting efficiency to tackle the next mystery and the next and the next." Martin (2010).</p> <p>"The answer is not to try to get corporations to embrace intuitive thinking at the expense of analytical thinking or vice versa. Rather it lies in a third form of thinking – design thinking – that helps a company both hone and refine within <b>the existing knowledge</b> stage and generate the leap from stage to stage, continuously" (Martin, 2010).</p>	Martin (2010)	<b>Process</b>
<b>L</b>	Language	<p>"When generating information and ideas, <b>language matters</b>. 'Yes, and' allows continuation and expansion, which is necessary in certain stages of CPS. The use of the word 'but' –whether preceded by 'yes' or 'no' – closes down conversation, negating everything that has come before it" (CEF Resource Guide, 2015)</p>	CEF Resource Guide (2015)	<b>Pillar</b>



M	Meaning	“Design Thinking can create <b>meaning</b> ... Creating meaning is the hardest part of the design process, and the communication tools used in design thinking – maps, models, sketches, and stories – help capture and express the information required to form and socialise meaning” Moottee (2013).	Moottee (2013)	Process
N	New perspectives	“Design thinking is a human centered way of viewing the world. By trying to solve problems through gaining insights around people’s needs, you’re creating <b>new perspectives</b> which lead to new opportunities for innovation. Innovation through new perspectives” (Glinski, 2015).	<a href="http://www.ideacouture.com/blog/the-relationship-between-design-thinking-innovation/">http://www.ideacouture.com/blog/the-relationship-between-design-thinking-innovation/</a>	Process
O	Openness and optimism	“The design thinking ethos is one of <b>openness, optimism, and collaboration</b> ” (Silvers, 2013). “Design thinking is a mind-set, an approach that forms a culture of <b>openness</b> .” (Makhoalibe, 2015). “Design thinking balances analytical and intuitive thinking. It <b>combines an openness to explorative thoughts with an exploitative mentality</b> , striking the balance between innovation and a systematic scalable process. It pulls resources back into the knowledge funnel and allows to progress through all three stages” (Martin, 2010)	<a href="http://artmuseumtea.ching.com/2013/05/23/design-thinking-in-museums-stepping-into-the-continuum-of-innovation/">http://artmuseumtea.ching.com/2013/05/23/design-thinking-in-museums-stepping-into-the-continuum-of-innovation/</a>  <a href="http://www.ccdi.org.za/news/252975/Design-thinking-in-26-ways.htm">http://www.ccdi.org.za/news/252975/Design-thinking-in-26-ways.htm</a>	Process
P	Play	“There’s a powerful relationship between creative thinking and <b>play</b> ” (Brown, 2010).	<a href="https://designthinkin.g.ideo.com/?p=743">https://designthinkin.g.ideo.com/?p=743</a>	People
Q	Qualitative Research	“Design thinking emphasises practical, ethnographically-inspired <b>qualitative research methods</b> that sit somewhere in between formal qualitative research and traditional market research and quantitative methods” (Young, 2014).  “Every problem is an opportunity for design. By framing your challenge as a How Might We <b>question</b> , you’ll set yourself up for an innovative solution” (Kelly, 2010).	<a href="http://zum.io/wp-content/uploads/2013/07/IDEASummit-DesignThinking-WithNotes.pdf">http://zum.io/wp-content/uploads/2013/07/IDEASummit-DesignThinking-WithNotes.pdf</a>  <a href="http://www.designkit.org/methods/3">http://www.designkit.org/methods/3</a>	Process
R	Rapid prototyping	“ <b>Rapid Prototyping</b> expressing a new concept in a tangible form for exploration, testing, and refinement” (Liedtka, 2014).	(Liedtka, 2014) <a href="https://generalassemb.ly/education/beginning-design-">https://generalassemb.ly/education/beginning-design-</a>	Process

		<p><b>“Prototyping and experimentation</b> produced conversations with real customers, a better source of information than PowerPoint presentations to colleagues in conference rooms. And all of this market-based learning generated forward momentum and energy for the project” (Liedtka, 2014).</p> <p>Brown and Wyatt (2010) explained design thinking as a methodology to problem solving that aids interdisciplinary team members to create a “vibrant interaction environment that promotes iterative learning cycles driven by <b>rapid conceptual prototyping</b>” (Leifer &amp; Steinert, 2011, p. 151).</p>	<a href="http://thinking/singapore/28680">thinking/singapore/28680</a>	
S	Storytelling	<p>“Using <b>storytelling</b> for better brand communications is hardly a new idea – many communications professionals, perhaps even you, have been doing this for a long time because you understand that telling your brand story as a narrative makes your brand more coherent and easier to connect with... emotionally! <b>Design Thinking frameworks and processes can help you achieve this</b>”.</p> <p>“They’re designed to shift the emphasis back to the human need for connectivity and meaning, back to empathy, exchange, participation, collaboration and understanding. And the <b>Design Thinking approach provides specific tools for crafting stories that stick</b>”.</p> <p><b>“Storytelling can be a very powerful exercise in Design Thinking.</b> It helps the designers/teams/participants of the approach to empathise with their users’ pain points, needs, aspirations, goals, uncover needs and build a solution that works for them” (Iyer, 2014).</p>	<a href="http://scn.sap.com/community/design-thinking/blog/2014/05/16/the-power-of-storytelling-to-build-empathy">http://scn.sap.com/community/design-thinking/blog/2014/05/16/the-power-of-storytelling-to-build-empathy</a>	Process
T	Trial and experimentation	<p>“Design Thinking is a human-centric, holistic approach to problem solving and business thinking that employs empathy, ideation, <b>prototyping and experimentation</b> to solve real-world issues” (Brown, 2010).</p>	<a href="http://ssg-advisors.com/author/lpodlog/">http://ssg-advisors.com/author/lpodlog/</a>	Process

		<p>"Design thinking - as <b>experiential knowledge</b> - is grounded in the uncertainty of the processes and embraces the notion of being able to go forward without clarity and without trying to define everything upfront". (Lui, 2014)</p>	<a href="http://designthinking-sydney.com.au/designthinkingsydney/news/design-thinking-social-change">http://designthinking-sydney.com.au/designthinkingsydney/news/design-thinking-social-change</a>	
<b>U</b>	Unlearning	<p>"To design our thinking, we have to become adept at working with mental models and managing thinking styles. This requires both <b>learning and unlearning</b>. You want people who are able to unlearn and shift their thinking. Do they have not only mental ability, but mental agility" (Bonchek, 2016).</p>	<a href="https://hbr.org/2016/06/design-how-your-team-thinks">https://hbr.org/2016/06/design-how-your-team-thinks</a>	<b>People</b>
<b>V</b>	Visualisation	<p><b>Visual</b> approach, <b>visualising</b> intangibles, <b>visual</b> thinking" (Drews, 2009).</p>	Hassi & Laakso (2011)	<b>Process</b>
<b>W</b>	Wicked Problems	<p>"Design thinking creates pathways for solving what Liedtka calls '<b>wicked problems</b>', where there is a high degree of complexity and only limited data to inform decisions" (Leidtka, 2014).</p> <p>"Design thinking belonged to the world of architects, product designers, interior designers, and graphic designers. But today a growing group of design practitioners is using their design skills and tools for social good. At the same times, governments, non-profit organizations, and social enterprises are experimenting with design thinking to discover and develop innovative solutions to complex local and <b>global 'wicked problems'</b>." (Lui, 2014)</p>	<p>Turning Design Thinking into Design Doing (Fraser, 2010)</p>	<b>Process</b>
<b>X</b>	Xenodochial	<p>"Xenodochial is an adjective describing something – such as a person, place or software application – that is friendly to strangers. Xenos is a Greek word for "strangers". According to the Oxford English Dictionary, xenodochial means hospitable." (Haslam, 2014)</p> <p>In this context, it means being collaborative to those who are strangers to you, your discipline, your culture etc. Both design thinking and creative problem solving encourage starting with diverse teams, and the important characteristic to be productive is to be open and collaborative to those</p>	<a href="http://whatis.techtarget.com/definition/xenodochial">http://whatis.techtarget.com/definition/xenodochial</a>	<b>People</b>

		who are different from you.		
<b>Y</b>	Yes and...	<p>There is a strong emphasis on teamwork and the importance of building on ideas through the use of <b>'yes, and'</b> thinking- the rule of always accepting and adding to other team-members' proposals [Fotis, 2014].</p> <p>"...whatever came to them, announced itself as a 'line of flight', they were not to ask what, how or why, but rather to say <b>'yes' and</b> make something ..." (Teal, 2010)</p>	Developing a (Non-linear) Practice of Design Thinking	<b>Process</b>
<b>Z</b>	Zoom out and in	<p>"To diverge ask 'Why?' and 'What if?' After you have finished diverging then you converge. <b>To converge you ask 'How?' and 'What is needed?'</b> Zoom out then zoom in". (CEF Resource Guide, 2015)</p>	(CEF Resource Guide, 2015)	<b>Process</b>

Based on the research findings from the review of existing literature on design thinking and creative problem solving the ABC of project artistry above was compiled. This ABC broadly represents the concepts that inform project artistry. All the emerging themes in the alphabet were deemed to be important in informing the project artistry model, although the sense-making process arising from these diverse concepts led to the construction of a more structured framework for facilitating exploration projects – described in the next section.

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
Ambiguity Tolerance	Brainstorming & imagination	Creativity & co creation	Diverse Teams	Empathy
<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>	<b>J</b>
Future-oriented	Glue between disciplines	Human-Centered	Innovation	Judgment on & off
<b>K</b>	<b>L</b>	<b>M</b>	<b>N</b>	<b>O</b>
Knowledge Funnel	Language of Creativity	Making meaning	New perspectives	Openness & Optimism
<b>P</b>	<b>Q</b>	<b>R</b>	<b>S</b>	<b>T</b>
Problem Solving	Qualitative Research	Rapid Prototyping	Synthesis & storytelling	Trial & experimentation
<b>U</b>	<b>V</b>	<b>W</b>	<b>X</b>	<b>Y</b>
Uncertainty	Visualization	Wicked Problems	Xenodochial	"Yes and..."
		<b>Z</b>		
		Zoom out & in		

Figure 19: Emergence of the ABC of project artistry

### 3.4 The emergence of the project artistry framework

Using the above concepts in the ABC of project artistry, the framework below was constructed using three key features that render project artistry practicable. This was achieved by using the following steps:

- I. Take a group of people whose characteristics reflect key concepts from the ABC such as diversity and openness.
- II. Be in a space of ambiguity and uncertainty.
- III. Guide through a process that facilitates brainstorming, imagination, empathy, human-centred approaches, visualisation etc. In this case, the creative problem-solving process was adapted within a project management fraternity in order to create a matching

process that would a project team from clarifying the problem/gap/opportunity to a place of clear project concepts.

- IV. This resulted in a more engaged and excited group with clearly defined project concepts.
- V. The ABC of project artistry was used to identify four pillars that could hold the entire framework together. This was achieved by exploring the relevant literature, as cited above, the ABC of project artistry and various definitions. The following pillars were identified, namely, diverging and converging, creativity language, applied imagination and reflection and learning.

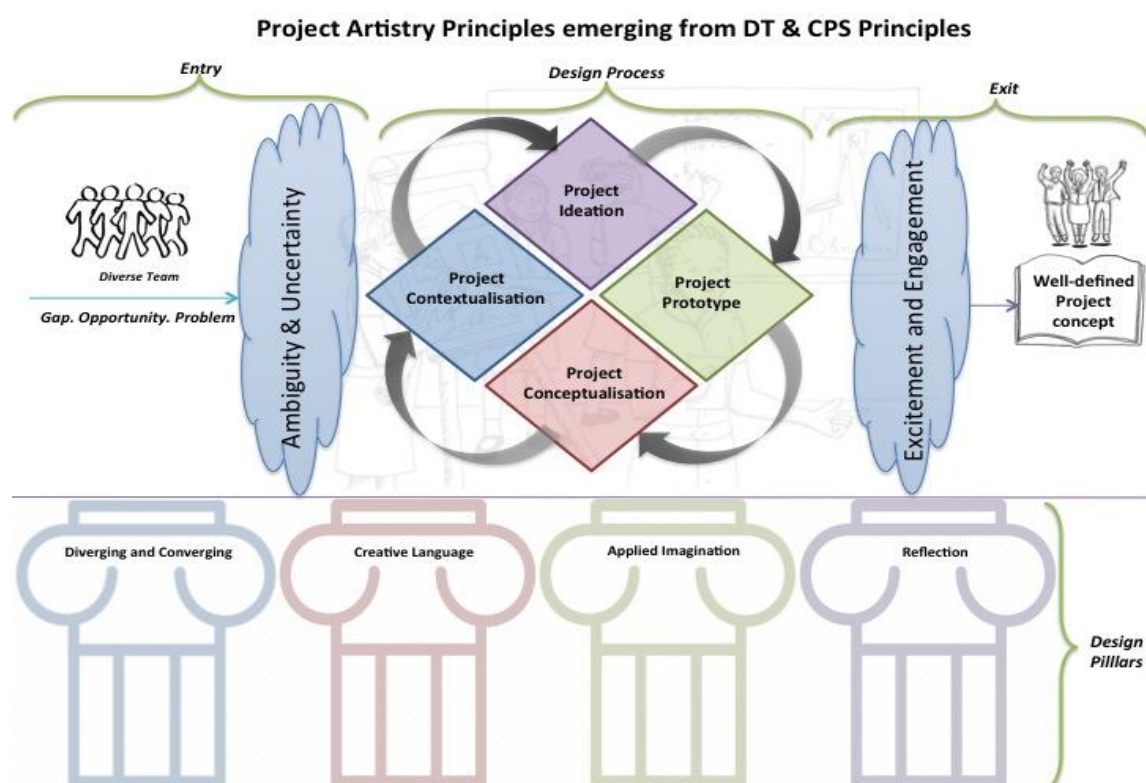


Figure 20: Project artistry framework

The project artistry framework is designed specifically for exploration projects to guide a project team from a place of ambiguity and uncertainty to a place where the team collaborates and co-creates projects with well-understood objectives and enablers. Figure 1 in the first chapter highlighted that the aim of this thesis was to build a framework that could be used to generate new, innovative project concepts from a place of ambiguity and uncertainty so as to be able to move to a place of known

objectives and enablers.

The framework is broad as the ABC included several themes and concepts. However, for the purposes of this thesis it was essential to extract specific project artistry principles that could be applied in the design-based research methodology and then to be refined and enhanced through the methodology. In order to do this, I undertook a journey of three stages of the journey. The design pillars used to identify specific principles for each stage are discussed in the next section. The following DBR guidelines were used to extract the necessary design principles.

In a practical sense, design principles may refer to the characteristics of a planned learning design (what it should look like) or its procedure (how it should be developed) (van den Akker, 1999). It is essential that they are expressed in a way that may inform practice (Wang & Hannafin, 2005).

Design principles are often presented in a format that lists the criteria pertaining to a particular learning environments and outcomes. When presented in this way they often start with a verb. The principles that emerged from the theories are summarised briefly below and are presented in a blue box while each the principle is presented in a beige box.

### 3.4.1 Entry into project artistry: Proposed ambiguity journey that leads to action

This framework illustrates the guidance provided by the use of principles from design thinking and creative problem solving.

#### 1. Diverse groups

The project team is must be diverse in terms of disciplines. This is supported by the following design principles:

Radical collaboration: Bring together innovators from varied backgrounds and with different viewpoints. Enables breakthrough insights and solutions to emerge from the diversity. Brown and Wyatt (2010) explained design thinking as a methodology for problem solving that assists

interdisciplinary team members to create a “vibrant interaction environment that promotes iterative learning cycles driven by rapid conceptual prototyping” (Leifer & Steinert, 2011, p. 151).

### **Design principle**

*1. Ensure that you enter the project artistry process with a diverse group of people.*

## **2. Problems are opportunities in which to apply CPS**

There is a fundamental principle in the creative problem-solving school of seeing problems as a source of new products, markets and opportunities. Although this does not happen naturally, it is this way of seeing that leads to new opportunities to solve such problems in creative, imaginative ways and, hence, the term “creative **problem** solving”.

### **Design principle**

*2. Shift your perspective of a problem and see it as an opportunity to innovate*

## **3. Ambiguity tolerance**

Hagen & Park (2013) suggest that people who have tolerance for ambiguity and uncertainty portray leadership styles that promote innovative, adaptive, and entrepreneurial behaviours. Isaksen (1985) mentions that Participants often become involved in CPS activities with which they may not be familiar but they remain open to the generation of novel and unusual perspectives. In order to do this, they must tolerate the ambiguity, which might accompany the use of certain CPS principles and techniques.



**Design principle*****3. Allow yourself to start from a place of ambiguity.***

The next phase after acknowledging and accepting the ambiguity in the project involves the project artistry process, which is a culmination of the creative problem-solving process and the design thinking process that merges the stages of both processes into four stages. These are rewritten and contextualised within the project management fraternity.

**3.4.2 Project artistry design process*****1. Project contextualisation***

The entry point into the project artistry design process is project contextualisation. This phase involves defining the problem, digging deep into the context, uncovering details that are not obvious about the problem and seeking to understand the underlying issues concerned. This phase draws on the design thinking principle of empathy. In addition, it also draws from the creative problem-solving principle of asking the right questions in order to clarify the problem and formulate a problem statement.

**Design thinking principle: Empathy**

“Design theorists, as well as practitioners, describe empathy as a crucial impact factor of Design Thinking (e.g. Brown 2008; Kouprie & Visser 2009; Kolko 2011; Carlgren et al. 2013) “In the realm of design, design-thinking is rooted in empathy, where you try to see from the perspective of a user of a given design or product. There is a lot more to design thinking than that, but in a nutshell it is about human centered design where empathy is king” (Weinlick, 2013).

**Creative problem-solving principle: Questioning**

*Creative problem solving is a process of asking advancing questions. It's a matter of asking the right questions at the right time to move the process forward. If you want to be more creative in your problem solving, learn the questions to ask and the proper sequence. When you ask questions – listen without judgement. (CEF Resource Guide, 2015)*

*Ask problems as questions. Solutions are more readily invited and developed when challenges and problems are restated as open-ended questions with multiple possibilities. Such questions generate much rich information, while closed-ended questions tend to elicit confirmation or denial. Statements also tend to generate either a limited response or no response at all.*

### **Design principle**

*4. Seek to uncover all the facts about a problem before moving into a solution space.*

## **2. Project ideation**

This stage entails coming up with as many solutions as possible to the problem before deciding on an applicable solution. Thus, it involves devising numerous options through imagination and brainstorming before integrating the options into one solution. In other words, this stage draws on the creative problem-solving principle stated below:

### **Creative problem solving: Deferred judgement**

*Fun, play and art has the potential to allow the participants the freedom to be creative when ideating and explore concepts that never crossed their minds before. (CEF Resource Guide, 2015)*

### **Design Principle**

*5. Engage an element of fun and play in order to create curiosity and allow the deference of judgement*

## **3. Project prototype**

This stage allows the project team to adopt a stance, make a decision and implement an artefact quickly in order to test, refine, learn from the experience and develop project concepts based on tangible tests.

### **Design thinking principle: Experimentation**

*“Rapid Prototyping expressing a new concept in a tangible form for exploration, testing, and refinement” (Liedtka, 2014).*

*“Prototyping and experimentation produced conversations with real customers, a better source of information than PowerPoint presentations to colleagues in conference rooms. And all of this market-based learning generated forward momentum and energy for the project” (Liedtka, 2014).*

### **Design principle**

*6. Seek to make a physical artefact that is as close to real experience as possible.*

## **4. Project conceptualisation**

Finally, after receiving feedback on the prototype created in the previous phase, a project concept may now be built based on both the co-creation process and feedback from experiment.

### **Design thinking principle: Co-creating**

*“Seeking that sweet spot of feasibility, viability, and desirability as you take into account the real needs and desires of your customers is part of what we at IDEO and the d.school call ‘design thinking’. It’s our process for creativity and innovation” (Kelly & Kelly, 2013).*

### **Design principle**

*7. Develop project concepts from the prototype which are empowered by user feedback and comments.*

### **3.4.2.1 Exiting the process**

As a result of the project artistry process, the move from a situation of ambiguity and uncertainty regarding objectives and enablers facilitated the development of clear project concepts.

### **3.4.2.2 Underlying principles of the project artistry process:**

The following four pillars hold the entire project artistry process together and are applied in every phase of the process.

#### **1. Diverging and converging**

*Keys to creativity are learning ways to identify and balance expanding and contracting thinking (done separately) and knowing when to practise them. Defer or suspend judgement (CEF Resource Guide, 2015) As Osborn highlighted in his early work on brainstorming, instantaneous judgement in response to an idea curtails idea generation. The appropriate and necessary time to apply judgement is during converging.*

#### **Design principle**

*8. Diverge to seek multiple realities, and then converge into fewer options that move you forward.*

#### **2. Applied imagination**

***"Exercise your imagination! The more creative you become, the more you will get out of life".***

***(Alex Osborn, 1952)***

***"Imagination is more important than knowledge.  
For while knowledge defines all we currently know  
and understand, imagination points to all we  
might yet discover and create" (Albert Einstein).***

*Osborn studied creative people to identify the natural process of how they naturally create good ideas. With the goal of approaching problems with greater imagination, he incorporated his learnings into the first versions of the CPS process, helping people learn how to be more deliberately creative (CEF Resource Guide, 2015).*

### **Design principle**

*9. Use imagination deliberately during every step of the process.*

### **3. Creative language:** *Focus on “Yes, and ...” rather than “Yes, but”.*

*Language is important in the generation of information and ideas. “Yes, and” allows the continuation and expansion which is necessary in certain stages of CPS. The use of the word “but”, whether preceded by “yes” or “no”, closes down conversation, negating everything that has come before it.*

### **Design principle**

*10. Ensure that creative language is used to constantly inspire more ideas.*

## **4. Reflection and unlearning**

*Design thinking is a reflective practice. The trial and error techniques in the design process represents a similar approach to the reflective practice which was proposed by leading social scientist, Donald A. Schön (1983), in that the design process revolves around situations rather than problems.*

### **Design principle**

*11. Incorporate the reflective practice throughout to encourage learning during the process.*

## **3.5 Summary of design principles of project artistry tested in this thesis:**

The following design principles were extrapolated from the emerging themes of project artistry as cited above:

*Table 11: Project artistry design principles*

<b>Project artistry design principles tested in this thesis</b>
1. Ensure the diversity of the project team.
2. Shift the perspective about a problem and see it as an opportunity to innovate.
3. Allow yourself to start from a place of ambiguity
4. Seek to uncover all the facts about a problem before moving into a solution space.
5. Engage an element of fun and play in order to create curiosity and allow the deference of judgement
6. Seek to make a physical artefact is as close to real experience as possible.
7. Develop project concepts from the prototype and which are empowered by user feedback and comments.
8. Diverge to seek multiple realities, and then converge into fewer options that move you forward.
9. Use imagination deliberately during every step of the process.
10. Ensure that creative language is used to constantly inspire more ideas.
11. Incorporate the reflective practice throughout to encourage learning during the process.

### 3.6 Research philosophy

A guiding theoretical scaffolding or paradigm is essential in research into and the study of social (Albrecht & O'Brien, 1993). Paradigms are general frameworks in terms of which to see life – they provide a set of assumptions about the nature of reality. A paradigm refers to what we think about the world but cannot prove (Lincoln & Guba, 1985). Paradigms guide a study by defining its nature through the dimensions of ontology, epistemology and methodology. Blanche and Durrheim (2006) defined these three critical dimensions as follows:

*Ontology* specifies the nature of the reality to be studied.

*Epistemology* specifies the nature of the relationship between the researcher and what may be known.

*Methodology* defines the practical way in which the researcher goes about doing the research in question.

This section discusses the epistemology and the ontology that guided this study. The methodology or used to conduct the study is discussed in Chapter 4. The way in which the data was gathered and analysed is also detailed in the methodology chapter.

### 3.7 Research paradigm

This section discusses the research paradigm that constituted the foundation for the study. In order to do this, it was necessary to revisit the research question that was addressed in the study and stated in Chapter 1.

Research question: *"How to facilitate an enabling project environment that stimulates creativity and encourages co-creation in exploration projects?"* This question was then divided into the following two sub questions:

1. *What are the design thinking and creative problem-solving principles that may enrich the process of vision creation and conceptualisation in exploration projects?*
2. *How may the emerging design principles be enhanced through experiments to ensure a more practical framework for managing exploration projects?*

The goal of this study was to understand a human phenomenon as well as the practitioners' experiences of this phenomenon. This goal was compatible with the philosophy, strategies and aims of the interpretive research paradigm. The interpretive research paradigm is based on the epistemology of idealism (knowledge is viewed as a social construction) which encompasses a number of research approaches with the central goal of seeking to interpret the social world (Higgs,

2001). The decision to use this paradigm was guided by the information presented in Table 1, adapted from Weber (2004), and which compares positivism and interpretivism. The last column reflects my own stance within this research study and which justified the adoption of interpretivism.

According to the interpretive paradigm, human beings construct meanings in unique ways, depending on their context and personal frames of reference as they engage with the world they are interpreting (Crotty, 1998). This is the notion of multiple constructed realities. In this type of research, the findings emerge from the interactions between the researcher and the participants as the research progresses (Creswell, 1998).

Accordingly, subjectivity is valued and it acknowledged that humans are incapable of total objectivity because they are situated in a reality which is constructed by subjective experiences. Furthermore, the research is value-bound by the nature of the questions being asked, the values held by the researcher, and the ways in which the findings are generated and interpreted.

In choosing a particular paradigm, certain assumptions and perspectives are accepted. The interpretive paradigm was deemed to be the most suitable for this research study because of its potential to generate new understandings of complex multidimensional human phenomena, such as those investigated in this study, namely, creativity, co-creation and collaboration in project management. Specifically, practical knowledge was sought, namely, knowledge which is embedded in the world of meanings and of human interactions. It was therefore appropriate to investigate this phenomenon within the interpretive paradigm.

Klein and Myers (1999) referred to the seven principles of interpretive research specifically when analysing ICT processes and social interactions in higher education (Klein & Myers, 1999: 72). I believed that these principles were applicable to this study as I was investigating both a process and the design principles which guided a process of creation. Consequently, I adopted them for the purposes of this study in order to guide my understanding and analysis.



The principles are listed below and then discussed:

1. The hermeneutic circle
2. Contextualisation
3. Interaction between researchers and subjects
4. Abstraction and generalisation
5. Dialogical reasoning
6. Multiple interpretations, and
7. The principle of suspicion.

#### 3.7.1.1 *The Hermeneutic circle principle*

*“Hermeneutics is about interpretations and making sense of meanings” (Lee, 2004).*

Viewing research as a hermeneutic process enables the scientist to focus on how far to enter into the research process itself, and to improve the understanding without compromising the validity of the enquiry (Lee, 2004).

Figure 22 depicts one-way of understanding how hermeneutics combines synthesis and analysis: synthesis is the process of combining the parts to make a whole while analysis is the reciprocal process of dividing the whole into its parts.

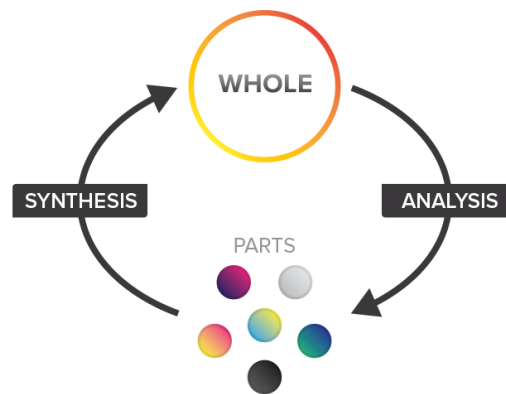


Figure 21:: The hermeneutic spiral

Source: (Lee, 2004)

In view of the fact that phenomena are subject to various interpretations, the principle of the hermeneutic circle places considerable emphasis on iterations between the interdependent meanings of the various parts of a phenomenon in relation to the whole that they form. The principle of the hermeneutic circle applies the iterative sense-making process between the terms and their meanings within a context in which to interpret phenomena. Firstly, I needed to understand the phenomena of design thinking and creative problem solving holistically. By using analysis, I was able to break down the principles of each into parts that guided the project artistry model, then again synthesise all the parts in order to create a holistic model, thus leading to a new approach to projects. The same process was repeated in the practical application of the framework in the iterations defined in the methodology chapter.

### 3.7.1.2 The principle of contextualisation

*We are a product of our environment, social context and history*  
(Vygotsky, 1978).

According to the contextualisation principle a research subject to be viewed within its historical, social and cultural contexts in order to help researchers to understand and account for the situation under investigation (Klein & Myers, 1999). The principle of contextualisation was applied in two ways in

this research study. Firstly, since this was multidisciplinary research based in the project management body of knowledge, but tested and applied in the context in the education field, it was imperative to understand the existing theoretical lenses in education, work closely with practitioners in the field, understand the situation under investigation and gain a contextual understanding of the field; hence the first three sections of this chapter. The choice of the research methodology was influenced primarily by this contextual understanding of the field and hence DBR was used. The research design used was founded in and popular in the education field although it is non-existence in the project management field.

Secondly, as discussed in section 3.3 above, the specific choice of testing was educational sandpits which usually attract diverse groups of educators with the aim of creating solutions. The specific groups that participated in this study were diverse in terms of the African countries from they came, age, gender and also the various disciplines from which they came. The portfolio of each group and their diversity in terms of these variables are discussed in the research methodology chapter. The principle of contextualisation was carefully embedded in the analysis phase and discussed as this influenced some of the variables involved in the interaction in co-creation.

#### 3.7.1.3 Principle of interaction between researchers and subject/s

*This principle suggests that insight in research emerges from the interactive process between the researcher and research subjects (Klein & Myers, 1999).*

A researcher is advised to place him/herself in a realistic historical context that will enable a meaningful interaction with the respondents when preparing for the data collection (Klein & Myers, 1999). The research methodology adopted for the purposes of this study took into consideration the role of the research, the practitioners and the subjects and, since it was a co-creation process, each role was clearly defined before starting on the study. This is discussed in the next chapter on research methodology in section 4.2 of stage 1 of DBR.

#### 3.7.1.4 The principle of abstraction and generalisation

*Using a theory in a sensitising manner rather than to falsify other theories is necessary to distinguish between research interpretations and anecdotal research (Klein & Myers, 1999).*

Although interpretive research does not seek to test and prove this hypothesis, theory does still play a significant role in this paradigm of enquiry. The principle of abstraction emphasises the use of an appropriate theoretical lenses to understand the situation under investigation and to enable some level of generalisation that helps in the development of concepts as well as in the drawing of inferences from rich insights (Walsham, 1995). In view of the fact that this was a multidisciplinary research study based in the project management body of knowledge but tested and applied in the context in the education field, it was imperative to understand the existing theoretical lenses in education, work closely with practitioners in the field, and find a common theoretical lens that would help to understand the situation under investigation. This led to the choice of DBR, which is concerned with co-creation, applying, testing, learning and redesigning for improvement.

#### 3.7.1.5 The principle of dialogical reasoning

*The researcher/s ensure that they do not allow personal prejudgements and bias to divert the actual meanings of phenomena in an investigation (Klein & Myers, 1999).*

The principle of dialogical reasoning emphasises the need to apply objective rather than biased reasoning in an investigation. Accordingly, the researcher is advised to clearly identify a specific philosophical and theoretical stance in order to interpret meanings to ensure that interpretations are consistent, unbiased and reliable. The first chapter discussed the positionality of the research so as to disclose all the biases and prejudices that may have impacted on the interpretation in this thesis prior to engagement as the researcher was the main instrument in terms of observations, facilitating the workshop and capturing and recording the findings. It is for this reason, therefore, that multiple data gathering methods were used in the study, including video capturing the workshops held, surveys

following the workshops, conducting interviews with each participant after the workshop, and recording the views of the practitioners, as well as reflecting on and making notes on the workshop.

#### 3.7.1.6 *The principle of multiple interpretations*

*The principle of multiple interpretations requires a researcher to account for multiple viewpoints in an inquiry, and to seek clarity on their motivations  
(Klein & Myers, 1999).*

This principle is closely related with the principles of contextualisation and that of researcher and subjects discussed above. In acknowledging and accepting the significance of historical, social and cultural contexts in shaping our perspectives of knowledge, interpretive research anticipates that people may attach various, and sometimes contrasting, meanings to similar concepts, terms or situations. Hence, the methodology adopted for the purposes of the study allowed for design and iterations, disclosed the research journey with the practitioners and educators and facilitated different stages that resulted in output that was recorded and agreed upon by the research and the practitioner to ensure the alignment of thought and common understanding of the relevant concepts. This is discussed explicitly in the research methodology chapter.

#### 3.7.1.7 *The principle of suspicion*

*In view of the possibility of false preconceptions, false consciousness, the existence of socially created distortions and psychopathological delusions, it may not be enough to only interpret the meaning uncritically (Klein & Myers, 1999).*

Authentic learning settings were sought in order to test this thesis. The participants were not informed of the research work that was taking place but participated in natural setting and were interviewed immediately after the week in which the workshops were held. It was only at the end of each setting that they were told that the workshops would contribute to an ongoing PhD thesis on the

journey on which they had embarked for the week. This was done specifically to test the phenomena in an untainted session and to remove any suspicion on the part of those who would encounter the results of the work. In addition, the methodology chosen also facilitated a platform that enabled the researcher to work closely with the practitioners in the field, thus allowing the journey of diverging and converging through this study. This led to the publication of the work academic journals and manuscripts and this in turn opened up opportunities to assess the quality and contribution of the work on an ongoing basis.

### 3.8 The epistemology of the study

Epistemology is the theory of knowledge, especially with regard to its methods, validity, and scope, and the distinction between justified belief and opinion. The epistemology selected for the purposes of this study was a combination of hermeneutics and DBR, which falls under the interpretive paradigm and uses qualitative methodology.

According to Creswell (1998), by using qualitative methodologies for inquiry into a social or human problem, the researcher builds a complex, holistic picture, analyses words, reports the views of participants in detail and conducts the study in a natural setting. This methodological approach addressed the stated aims of the study in that it enabled a framework for providing a holistic picture of the educators' experience. The interviews with the educators attempted to make sense of or interpret their experiences in terms of the meanings that they brought to these experiences (Creswell, 1998).

### 3.9 Chapter 3 summary

The objective of this chapter was to clearly identify the gaps in the project management body of knowledge by conducting a review of relevant literature in the field of project management. This was

followed by a review of the literature on the emergence of project artistry which emanates from the concepts of creative problem solving and design thinking. This led to the formulation of the proposition of the thesis, namely, on how project artistry may possibly create a new mind-set in the project management of explorative projects in order to facilitate the individual and collective creativity that enables innovation. Thus, the proposition of this thesis focused on project artistry which is believed to embody the creativity processes that enable the tapping into individual and collective creativity in order to generate novel project concepts.

## Chapter 4: Research Methodology

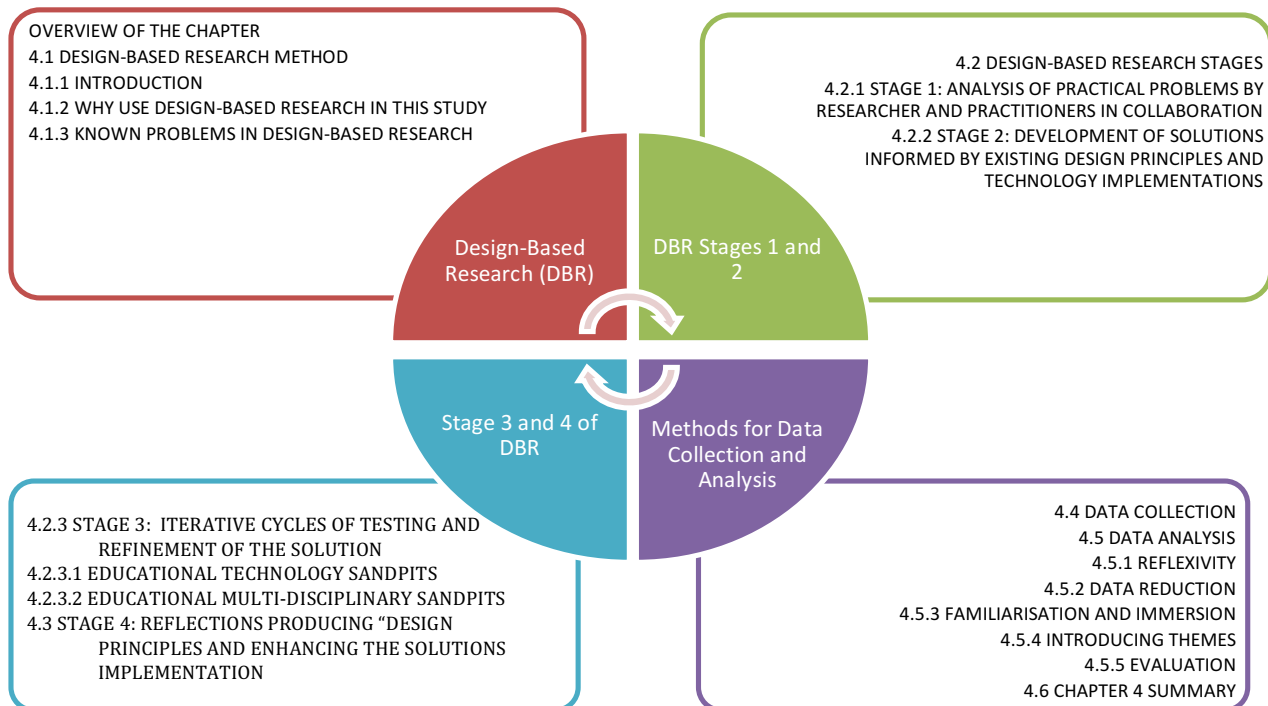
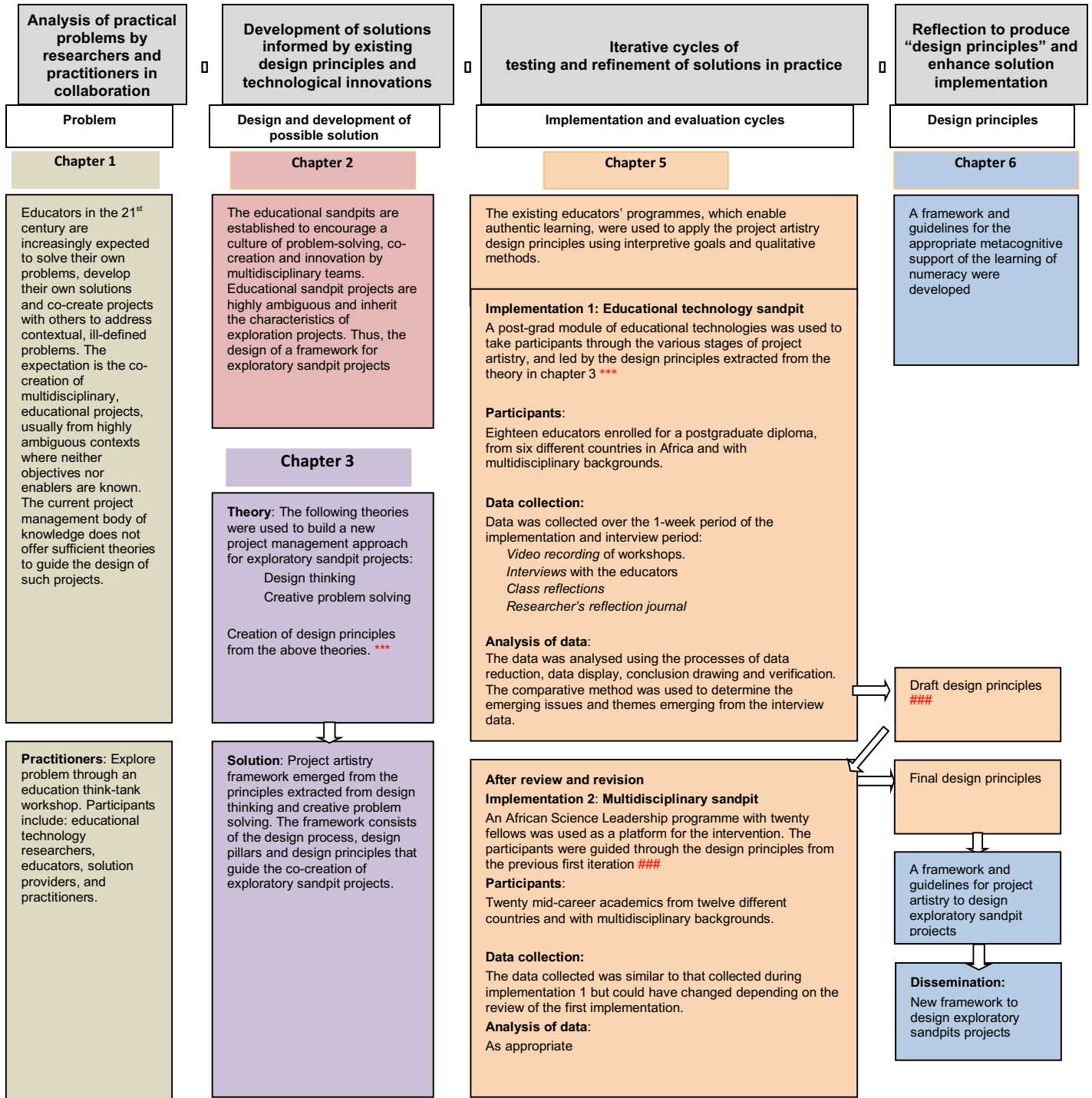


Figure 22: Overview of Chapter 4



### The diagram showing the research methodology adopted in this thesis.

There is no explicit place for Chapter 4 in this diagram as it embodies the whole research methodology.



(Adapted from Reeves (2006, p. 59))

## Overview of the chapter

The previous chapter discussed the context of the study, which was situated in the education field, specifically in the emerging concepts of the educational sandpits. The chapter also highlighted the research paradigm used in the study. The main aim of the study was to test the effectiveness of the emerging project artistry principles that emerged from the relevant theory (Chapter 2) on the management of exploration projects in real life in the educational sandpits context in order to enhance the solutions arrived at. Chapter 3 pointed out that the projects handled in the educational sandpit are characterised by high levels of ambiguity and uncertainty and, thus, constituted a suitable space in which to test the proposition of this thesis.

The epistemology chosen was a combination of hermeneutics and DBR, which falls under the interpretive paradigm and uses qualitative methodology. This chapter discusses the design-based methodology which was adopted for the study and justifies its use to carry out the inquiry. The chapter then describes how the methodology was used in the study through the four stages of DBR and the data collection methods used.

## 4.1 Design-based research method

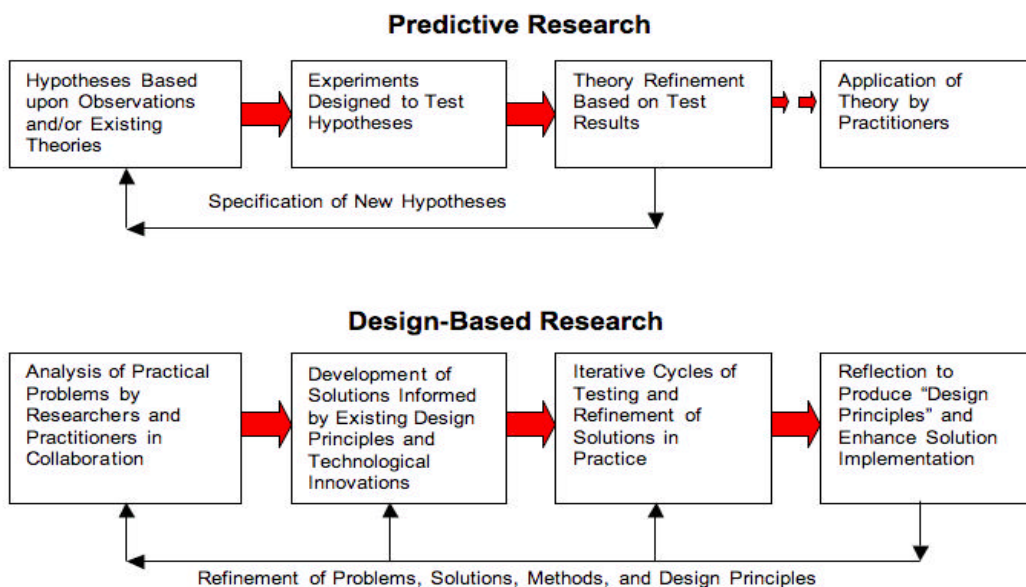
### 4.1.1 Introduction

There has been general acknowledgement among contemporary researchers that learning (student, group, organisation) does not occur in a vacuum but, rather, that it is affected by a complex set of interrelating factors (Lesh, Doerr, Carmona, & Hjalmarson, 2003). Addressing this complexity in a disciplined way is the essence of research design (Lesh et al., 2003). DBR (also called development research, design research or design experimentation) methods integrate design and empirical research methods with the aim of developing models for and an understanding of learning in naturalistic, intentional, learning environments (Tabak, 2004).

Design research represents a reconceptualisation of learning theory as something that may be shaped by researchers and practitioners in context (Reeves, Herrington, & Oliver, 2004). The differences between predictive and developmental research approaches are summarised in Figure 24 in page 132.

Design research occurs at a level that allows ‘embodied conjectures’ to develop learning theory (Sandoval & Reiser, 2004). As opposed to directly developing ‘design principles’ which are articulated at a general, untestable level, embodied conjectures are based on the existing knowledge of learning in a particular domain and that may be challenged by trial (Sandoval & Reiser, 2004). The empirical refinement of embodied conjectures may lead not lead to the enhancement of particular learning environments but also to developments in learning theory itself (Sandoval & Reiser, 2004). An example of one such type of learning theory development is ‘ontological innovation’ – the introduction and refinement of new categories of existence (DiSessa & Cobb, 2004). DBR facilitates the development of theory that may be directly applied while involving elements of generalisation (DiSessa & Cobb, 2004).

Figure 23: Predictive and design-based research approaches in educational technology research



Source: (Reeves, 2006)

Because DBR is set in authentic learning environments there are many variables that cannot be controlled. Instead, design researchers attempt to optimise the design as far as possible and to observe how the different elements interact (Collins, Joseph, & Bielaczyc, 2004). Collins et al. (2004, p. 20-12) cited the following seven differences between laboratory studies and DBR in their rationale for design experiment studies:

1. Laboratory settings vs. messy situations
2. A single dependent variable vs. multiple dependent variables
3. Controlling variables vs. characterising the situation
4. Fixed procedures vs. flexible design revision
5. Social isolation vs. social interaction
6. Testing hypotheses vs. developing a profile
7. Experimenter vs. co-participant design and analysis.

Based on these differences (ibid) argue that design research is able to fill a gap between the case based focus on sociological and contextual factors provided by ethnography and the large scale quantitative approaches that focus on the cause and effect of critical variables.

The following five features of design experiments are suggested by Cobb, Confrey, diSessa, Lehrer, and Schauble (2003, p. 9-11) which cut across the diverse range and types of research to embody the approach:

1. Development of a class of theories about the process of learning and the means of supporting that learning
2. The highly interventionist nature of the methodology
3. The paradoxical use of theories to form conjectures that may form new (potentially contrary) theories
4. The iterative design to implement the prospective and reflective aspects of theory formulation
5. The development of theories that are applied in nature.

DBR is highly interventionist and developmental, and it happens in a natural setting, hence its distinctive attribute is that the research team deepens its understanding of the phenomenon under investigation as the study progresses (Cobb et al., 2003). It becomes necessary to comprehensively record and document an ongoing design process in order to provide support for the rationale behind design decisions and to provide a clear trail of evidence regarding the findings that are reported (Cobb et al., 2003)

Two other important aspect of DBR relate to the structure of the method applied. Firstly, in DBR the approach to redesigning environments should be both deliberate and well-reasoned (Sandoval & Reiser, 2004) and, secondly, a systematic approach to analysis should be adopted (Cobb et al., 2003; Sandoval & Reiser, 2004).

#### 4.1.2 Why use design-based research in this study

Reeves, Herrington and Oliver (2004) suggested that DBR is a suitable method for investigating technology based learning approaches as it is a promising way in which to:

- a. Explore possibilities for creating novel learning environments
- b. Develop theories of learning that are contextually based
- c. Advance and consolidate design knowledge
- d. Increase the educational community's capacity for educational innovation.

(The Design-Based Research Collective, 2003, p. 8)

The ability to engineer the environment provides a measure of control as compared to purely naturalistic investigation, thus permitting effects to be detected (Cobb et al., 2004). The capacity to manipulate the learning designs enacted in the web-conferencing environment allows the impact of changes to be measured. Furthermore, Cobb et al., (2004) suggest that, in attempting to support specified forms of learning (for example, student-centred learning), relevant factors that contribute to

the emergence of the form of learning in question are likely to be encountered and this, in turn, allows an awareness of their interrelations to be developed.

The naturalistic basis of the DBR approach closes the “credibility gap” between educational research and practice that exists in certain methodologies (The Design-Based Research Collective, 2003). DBR operates at a level that constitutes a means of addressing the complexity that is a hallmark of educational settings (Cobb, et al., 2004). The multiplicity of tools made available by the web-conferencing system, the various types of content that may be addressed and the choice of activity designs that may be used combine to create a complex environment for studying teaching and learning. DBR is able to incorporate both the influence of authentic settings as well as the potentially multifaceted nature of outcomes, thus providing a more complete and realistic understanding as compared to research that is conducted in impoverished contexts that consider isolated variables only (Barab & Squire, 2004; Lesh et al., 2003). This is particularly valuable in analysing the dynamic design potentials of the web-conferencing environment and which are less easily examined using the more rigid methodological frameworks.

In view of the fact that DBR focuses on the process of learning it is able to provide insights into both the complexity of developing knowledge and the role that the teacher plays in leveraging the potential of the learning resources available. Both of these may have gone unnoticed if more quantitative or summative foci only been adopted (The Design-Based Research Collective, 2003). DBR allows the more realistic possibility of the teacher as the reflective practitioner in educational development projects by not enforcing an artificial line between researcher and subjects (Lesh, 2003). The role of the teacher as both designer and manager in the web-conferencing environment becomes an important aspect of the authentic context of the study. A positive consequence of this dual role is that a greater degree of methodological alignment may be achieved by having the same person or people engage in the theory, implement the interventions and measure the outcomes (Hoadley, 2004).

The cyclic and iterative processes involved in DBR are more in alignment with the authentic design of learning environments (Lesh, 2003). However, DBR extends beyond the design, implementation and

testing of environments that subsume most other approaches to developmental research in attempting to generate theories about teaching and learning (The Design-Based Research Collective, 2003). The use of a DBR approach to study teaching and learning in the web-conferencing environment not only emulates the realistic process of teachers engaging in reflective practice to form understandings but also supports the distribution of understandings through a mandate for theory generation.

DBR permits the use of any and all types of data in order to arrive at an effective design, for example, the expertise of the teachers and the designers (Gorard, Roberts, & Taylor, 2004). This enables the accumulated experience of the teacher-researcher with the web-conferencing system to inform descriptions so that relevant knowledge may be passed on to those unfamiliar with the environment. In addition, design experiments value rather than discard ineffective designs as providing useful information regarding the way in which users respond to particular approaches. This may provide a more illuminating starting point for the next phase of the design process than if a semi-successful design had been implemented (Gorard et al., 2004). Using all the sources of data when analysing the influence of content, activity and technology upon teaching and learning enables a more rapid design progress to be achieved than if this information had been discarded.

The evaluation between various versions of the artefact being created based on design-based research are:

- (i) real-world intervention and
- (ii) a theoretical contribution (i.e. design principles for project artistry and a framework for project artistry)

#### 4.1.3 Known problems in design-based research

The Design-Based Research Collective (2003) discusses some of the issues that may be involved when conducting DBR:

Complications often arise from sustained intervention in messy settings. A single, complex intervention (e.g., a 4-week curriculum sequence) may involve hundreds, if not thousands, of discrete designer, researcher, and teacher decisions – hopefully all working in concert in an attempt to promote innovative practice. In such situations causality may be difficult to decipher and disambiguate; logistically it is not possible to pursue all possible factors equally pursued; the precise replication of an intervention is largely impossible; while emergent phenomena regularly lead to new lines of inquiry which are informed by current theories or models of the phenomena (p. 7)

Accordingly, DBR relies on the researcher to identify potential confounding effects and provide his/her interpretations of the interrelations based on their proximity to the context.

One issue that any research must consider is the extent to which a nomothetic (studying many subjects on fewer variables) versus idiographic (studying fewer cases in detail) approach is adopted (Brown, 1992). Nomothetic research provides quantitative support for the principles of behaviour, while idiographic approaches allow the in-depth understanding of contextualised cases to inform the field. In view of the fact that DBR aims to derive generalised principles for the teaching from studies of specific contexts, a view that incorporates a degree of both nomothetic and idiographic approaches is appropriate (Brown, 1992).

It is also essential that design-based researchers are aware the Hawthorne effect in terms of which every change results in an improvement in performance. One way in which Brown's (1992) foundational design research study into developing communities of learners accounted for this effect was by noting that successive refinements resulted in specific and predicted changes in behaviour rather than in general improvement. Brown (1992) also forewarned of romanticising the novelty of findings. In view of the fact that this research study related to the relatively unexplored area of teaching and learning using computing, the likelihood of this was reduced. However, the researcher is obliged to identify cases where effects represent enactments of the principles observed elsewhere.



Another issue in DBR relates to biases in the data selection in order demonstrate findings (Brown, 1992). When portions of transcripts are selected to illustrate a theoretical point from a large array of possible examples, there is a high potential that the dataset may be misrepresented. However, this may be addressed by using systematic approaches to represent the entire dataset, and then choosing specific cases to illustrate points from within the dataset. This approach was adopted in this study with the prevalence of each point being represented was indicated by a cross-reference to all the instances within an iteration. This allowed the reviewer to ascertain the pervasiveness of the effect throughout the study, thus averting selection bias. In addition, attempts to make the research process as open and visible as possible allow other researchers to gauge the accuracy of claims made (Brown, 1992).

While positivists may criticise DBR for lacking rigour, Hoadley (2004) argues that DBR is more rigorous than experimental research in connecting interventions to outcomes in complex and realistic settings. This, Hoadley claims, may lead to a better real-world alignment between theory, treatments, and measurement as compared to experimental research.

The next section discusses the particular application of DBR in the context of this thesis.

## 4.2 Design-based research stages

### 4.2.1 Stage 1: Analysis of practical problems by researcher and practitioners in collaboration

#### **Background:**

The first stage in research-based design is an extremely engaging stage, involving both the researcher and the practitioners unveiling and digging deep into the problem situation (Reeves, 2006). Depending on the problem at hand and the complexity of the situation, this may be a time-consuming exercise involving probing questions and creating an atmosphere of brainstorming. This is very similar to the first step of the design thinking process that involves empathising and seeing the world

from the user's perspective and using this lens to define a problem. In view of the fact that, at the time of the study, I had worked in the educational technology space for over a decade, it was critical to remove my own biases and prejudices regarding the subject. I then had to find the relevant practitioners and create an atmosphere that allowed them to contribute and analyse the problem situation.

My experience as a design-thinking practitioner for several years allowed me not only to understand this stage but also to respect it as a very critical stage in the process. First identifying whom the practitioners in this field were and then guiding them through a process to carefully analyse the problem situation and agree on the problem was key to this stage.

### **Identification of practitioner:**

The University of Cape Town (UCT) Educational Technology Enquiry LAB (ETILAB) was identified as a place in which to start conversations. The UCT ETILAB is the brainchild of Professor Dick Ng'ambi from the UCT School of Education. In the context of this thesis, he is a practitioner in the field in which the proposition formulated for the purposes of this thesis was being tested. This initiative had paved the way for educators from all over the world to experiment, co-create and develop homegrown solutions to their education problems.

### **The think tank workshop**

In October 2014 the ETILAB planned an educational technology think tank workshop of which the objective was to gather together all the relevant stakeholders in the educational technology field to discuss issues relating to education in South Africa. These were representatives from corporates that specialised in educational technology, teachers, researchers in the educational technology field, Intel (the well-known technology giant that is the main sponsor of the ETILAB, and several other

stakeholders).

These people were there to discuss, debate, brainstorm and analyse problems relating to education in South Africa. As an enthusiastic researcher in the space, I co-facilitated the sessions to guide the process, using tools from the design-thinking process. This allowed the participants to come to the space with the openness and acceptance required to ensure that each person contributed and that ideas were offered by each individual as the very diverse group represented diverse insights, perspectives and interests. It was important to hear everybody, with some being asked to present their worldview in relation to education in South Africa.

### **The methodology**

Using thematic analysis, the input from the leading experts in the field from the brainstorming sessions was themed, coded and presented to highlight all the emerging themes and, eventually, to identify the root cause of the problems in education.

### **The problem**

The problem is elaborated upon in the next chapter on data analysis, **“the educator”**. However, the educator was found to be the main leverage point in the system, with the analysis clearly highlighting the factors relating to the educator that were brainstormed. The diverse group represented at the think tank workshop concluded the discussion on the educator with a statement that was congruent with the systems thinking causal loop process that, among the number of problems raised, had **the educator** as the main intervention point. Once this had been established, the group was then led through a process of conceiving the educator in 2030 using imagination and synthesis. The results are discussed in the next chapter on the data analysis.

### **Conclusion on this stage:**

The educator was identified as the main problem in education in South Africa. Many aspects of the educator were discussed. Chapter 5 contains a detailed discussion of the analysis. It is worth noting that it was highlighted that the educational sandpits build their mission on the following problem, namely, *facilitating a platform for the empowerment of the educators to solve their own problems*.

#### 4.2.2 Stage 2: Development of solutions informed by existing design principles and technology implementations

This stage involved the development of the solution or intervention in respect of the problem in education. It had become apparent from stage one that problem solving was at the heart of the educator's expectation. This is discussed further in the next chapter on the data analysis. The development of the solution to the problems comprised two stages:

- i. Firstly, Chapter 3 discussed educational sandpits as an emerging concept in Africa designed to empower educators to initiate, develop and implement their own educational solutions. This addressed the problem emerging from stage one, regarding the empowerment of educators for collaborating on, co-creating and developing projects that address their own contextual problems. I am strongly of the opinion that ***educational sandpit projects are exploration projects with high levels of ambiguity and uncertainty*** (see Figure 1).
- ii. Secondly, Chapter 2 discussed the knowledge gap in project management and the emergence of design thinking and creative problem solving with the rich principles, processes and mind-sets that may address this gap in the body of knowledge. I proposed the use of ***project artistry design principles that embody creative design thinking and creative problem-solving principles in the project management of exploration projects***. The project artistry design principles

discussed in Chapter 2 and used in this thesis were presented in Table 10 in Chapter 3.

#### 4.2.3 Stage 3: Iterative cycles of testing and refinement of the solution

This thesis was tested in the education field on the African continent. The emerging concept of educational sandpits was used in this testing. The following two conceptions of the first educational sandpits in Africa include:

1. The Educational Technology Inquiry Laboratory at the University of Cape Town and which focuses on empowering educators to develop “home-grown solutions” to education using technology.
2. The African Science Leadership Programme (ASLP), which is aimed at empowering mid-career African academics in the areas of thought leadership, team management and research development, with the intention of enabling them to contribute to the development of a new paradigm for science in Africa and focused on the contribution of this paradigm to solving the complex issues facing both Africa and the global community through projects.

The common factor in both these sandpit concepts is the ability to initiate, implement and manage highly complex, ambiguous, uncertain educational projects through diverse teams. These appeared to be credible as regards the testing space in this thesis, as they both attest to the complexity and ambiguity of projects, which are similar to those addressed in this thesis as exploration projects.

As mentioned in Chapter 3, the epistemology chosen for the purposes of the study was a combination of hermeneutics and design-based research, which falls under the interpretive paradigm and which uses qualitative methodology.

##### 4.2.3.1 Educational technology sandpits

The fundamental aims of the Emerging Technologies Inquiry Laboratory – famously known as the ETILAB – are to inspire the participants, using well tested techniques, to find their own homegrown

solutions to their unique set of problems in schools or in the workplace.

“At the ETILAB we promote concepts concerning collaborative inquiry, investigation, incubation, innovation and information sharing. Participants learn through fun filled activities how to utilise emerging technologies to solve their problems and thus take ownership for their own change and transformation” (Ng’ambi, 2014).

*# “The environment within the ETILAB recreates the playful conditions of a ‘sandpit’ environment, being a safe, secure, inviting environment where one has great fun interacting with peers while building imaginative prototypes.” (Practitioner)*

For example, the ubiquitous nature of educational technology artefacts has made them very popular, especially in the developing world context where technology is seen as a powerful resource that brings access and reach to unreachable places, but is also capital intensive and unaffordable by many. Thus, there is a tendency to adopt and customise solutions that have been developed for different markets and in different contexts to fit the local needs. This usually leads to failure and frustration on the part of those using these customised solutions that do not speak directly to their specific needs. The high failure rate of educational technology projects and which are deemed crucial for economic development and socio-economic empowerment has an unfathomable impact on education.

The educational sandpits build their model around empowering, encouraging and emphasising with the educator by designing places where the educator is able to co-create new solutions. This is congruent with the ETILAB slogan, namely, “*A sandpit for inspiring home-grown solution*”. The practitioner bases this on several years of research into educational technologies. The educational sandpit concept has emerged as a way in which to facilitate experimentation, sharing, empowerment and co-creation by educators. This is particularly relevant in the African context where resources are limited and there is constant pressure to cut budgets, be more productive, and share existing resources.

Having identified the twelve main themes embedded in project artistry, each stage was enacted over the five-day period of the workshop. The entire workshop with all the students all working together was recorded and interviews and surveys were conducted with the participants.

Once again, I was very careful in relation to my own subjectivity about the subject. It was essential that I provided an authentic learning environment and also that I ensured that I was sufficiently open to learn from my subjects. I recorded everything that unfolded in the workshops. The process included workshops of two hours that were held every afternoon. These workshops launched the students into a design process for the day regarding problem solving contextually relevant problems in their fields.

### **Creativity, co-creation and collaboration in the ETILAB:**

A problem inherent in the educational sandpit concept as a new phenomenon in the African context may not be well embraced or understood by those invited to “play” with technology. The concept of play may not be immediately appealing to the target market, for example educators, as they may not be able to identify easily with it. Why would this be this so?

In his book, “What a great Idea”, Thompson (2007) suggests that our creativity declines as we grow up and age. The red graph in the diagram below depicts this decline in creativity relative to age.

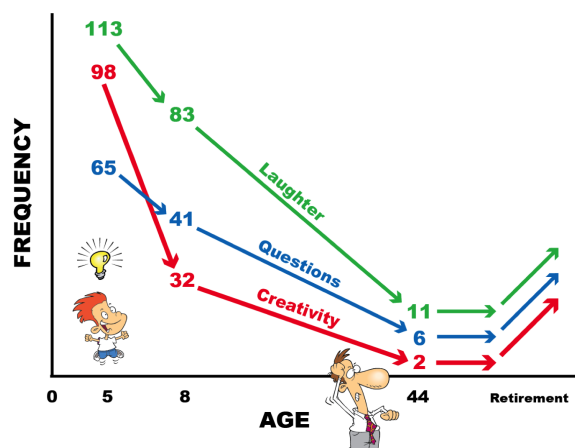


Figure 24: Creativity graph

[Online image] Available from: <http://whatagreatidea.com/tag/creativity/>

[Accessed 10/09/2014]

As per Figure 26 above, as five-year-old children, when we are taken to the sandpit, it was natural to play and enjoy creating with our hands and building with others. However, this is not as natural when we grow up. Hence, the concept of the sandpit for educators, as adults using approximately 2-5% of their creativity, may not sound very appealing. Thus, the first problem which arises involves triggering the educators interested in this space and helping them to see it as their own space and feel comfortable accepting the invitation to “play” in the sandpit

The second problem is the fact that, when they arrive at the ETILAB sandpit, they may come with their own perspectives and processes from their schools and these are associated with serious work and performance. Consequently, they may not realise the spirit or ethos of the ETILAB unless a clear process is defined by the ETILAB and it is one that includes empowering or equipping them with a creativity tool that allows them to revive their childhood creativity and play in the educational sandpit.

### **Culture of Creativity in the ETILAB Design Process**

It is vital that the design process used by the ETILAB has embedded in it culture of creativity and the processes that allow users to be creative and tap into their innate human ingenuity in order to devise brand new educational technology solutions in the space. One of the key objectives of the ETILAB is to encourage, inspire, ensure that the space users produce homegrown solutions that are context based and address unique contextual challenges. One of the problems highlighted in the think tank workshop was the pressure to use educational technologies developed in first world countries and that were developed specifically for unique contexts in the first world environment. The outcome is often resentment and “white elephants” in certain schools as educators do not relate with these solutions and are not able to justify their use.

# *“Through many years of research in the educational technology space, the practitioner, mentioned empirical evidence from many countries in Africa shows that some of the pre-packages technology*



*solutions that are meant to be customized and adopted in our environment end up either unaffordable due to the resource constraint experienced in the African context or ineffective in this environment as they overlook some of the fundamental problems that the continent is still subject to, such as infrastructure, connectivity, and basic needs” (Ng’ambi – the Practitioner).*

Thus, the emphasis of the ETILAB sandpit is on developing brand new, context relevant, effective solutions that address existing and real problems on the Africa continent. It must, however, be pointed out that the spirit of creation and devising are not natural in the education where the introduction to technology has been primarily consumptive and grounded in “others” developing solutions for “my problems”. Thus, the first hurdle faced by the ETILAB was to break cultural barriers and experiences that are anti creativity and co-creation in order to foster the development of own solutions.

### **Embodiment of the project artistry within the context of educational technology sandpits.**

During 2014, in the Emerging Technologies Post-Graduate module, the researcher was given an opportunity to test the ETILAB model with eighteen educators from six different countries in Africa who had gathered for their final module in the programme for a full week. The researcher used this module to access the richness of the diverse group of educators who were bringing with them various experiences from different contexts. This facilitated a perfect platform on which to test the project artistry framework.

The students had no previous knowledge of either the project artistry framework or mobile application development. This ensured an authentic environment in which to test the process, as they had not been taught about the process although it was integrated into the programme in such a way that they enacted the different stages of the process on a daily basis from Monday to Friday. Each day they were guided toward developing mobile applications that would address the persisting education problems in their context.

*\* Despite my years of experience facilitating design-thinking workshops, this context was different*

*in that it involved testing my own framework. It was, thus, essential that I laid aside my own subjectivity and prejudices in order to engage authentically with the process.*

The practitioner was able to observe closely the enactment of the model and to contribute to the discussions on its effectiveness, weaknesses, strengths and opportunities to improve it.

The educators received guidance on a daily basis on the various stages of the process but without being told what the actual process was or about the relevance of each afternoon that they spent engaging in the process. They were divided into groups of three, thus, there were six groups pairing to follow the process in order to develop mobile applications that addressed the education problems identified by the groups in their own context.

This led to close observations and engagement that culminated in feedback, the modification of the process and the outlining of important aspects that remained. The entire process was videotaped for the purpose of data collection in the interests of both learning and analysis. In addition, the candidates were interviewed at the end of the process and provided written feedback on it.

### **The ETILAB project phenomenon**

As discussed in Chapter 3, the educational technology sandpit is intended for the design of exploration projects. These projects are vague and require high levels of creativity the purposes of co-creation and innovation. Exploration projects constituted the test environment for this thesis.

As indicated in Chapter 2, the project management body of knowledge at the time of the study had been found to be lacking in empowering individuals to deal with exploration projects. Hence, the proposition of the thesis to draw from the project artistry principles in order to facilitate the development of such projects and, therefore, allow for the rapid experimentation that would lead to greater clarity as regards project objectives and the means to achieve such objectives.

It had therefore been deemed necessary to devise a design model for the ETILAB that would

incorporate all the principles of project artistry to facilitate the development of a process that could be followed by the educators to guide the development of these educational technologies. The emerging process became known as the ETILAB design process. The process embodied the project artistry framework in the acronym ETILAB. In their paper on design thinking as a catalyst for a culture of innovation, Makhoalibe and Ng'ambi (2014) demonstrated how project managers may draw on the power of design thinking to address the “wicked” problems confronting them daily in their attempting to navigating the complexity inherent in innovative projects. These principles are draw upon in this thesis.

The ETILAB design process embodies these critical steps and guides the thinking process of those who develop solutions in the education and technology space. The key principles of project artistry embodied within the ETILAB acronym were deemed creative and impactful in, firstly, presenting the ETILAB as not just another technology laboratory but also a process to be remembered and, secondly, as creating a culture that includes the problem solving, rapid prototyping, co-creation and empathy, which are core to the project artistry framework.

Figure 26 in page 149 presents this adaptation. The arrows indicate the iterative nature of the process that allows iterations to modify and re-design the artefact with the users.

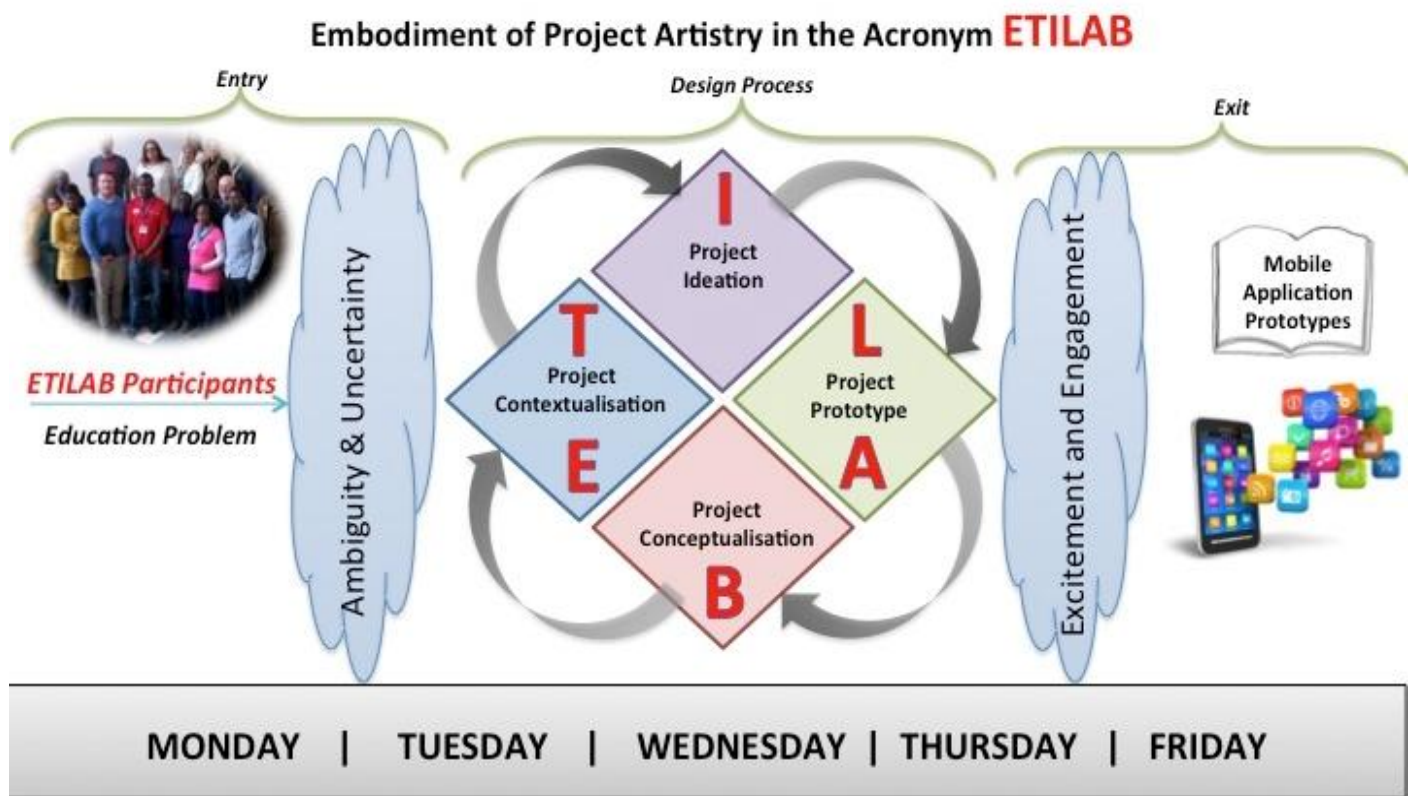


Figure 25: ETILAB design process embodied in the project artistry framework

#### 4.2.3.2 Educational multi-disciplinary sandpits

The second iteration is the African Science Leadership Programme (ASLP), which aimed at empowering mid-career, African academics in the areas of thought leadership, team management and research development was intended to enable them to contribute to the development of a new paradigm for science in Africa. These iterations focused on the contribution of this paradigm to solving the complex issues facing both Africa and the global community through projects. The enhanced design principles were applied in a different setting and a similar process followed to create a vision for innovative multidisciplinary projects in Africa. Figure 36 below illustrates how the project artistry framework is embodied in the multidisciplinary sandpit. It is important to note that the design principles that emerged from the first iteration informed the process in this iteration. The chapter on the data analysis elaborates on this. The same data collection methods and observations were captured to in order to further refine the model and come up with enhanced design principles that had informed the original model.

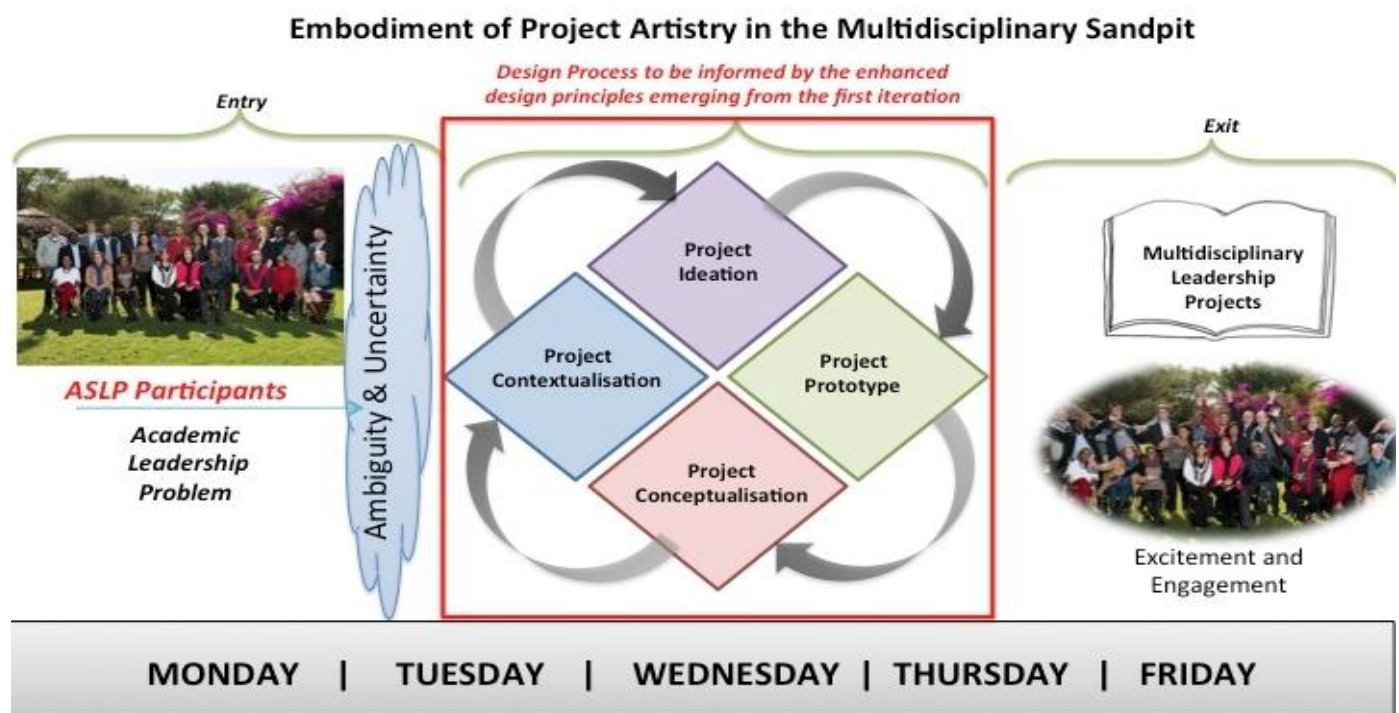


Figure 26: Project Artistry in the context of multidisciplinary sandpit

### 4.3 Stage 4: Reflections producing “design principles and enhancing the solutions implementation”

Finally, the last stage of the DBR involved using the reflections from the iterations, practical work and the empirical evidence collected to refine and enhance the design principles so as ensure effective solutions implementation. Using all the data listed above this stage focused on refining not only the ETILAB model but also to use the data and feedback to refine the ethos, culture and values of this innovative space.

## 4.4 Data collection

The main aim of this study was to gain an understanding on how the project artistry process may facilitate the clarity of project vision that leads to more novel, contextually relevant solutions to local problems than may otherwise have been the case. A qualitative approach was selected and thus the data collection methods used were aligned with the requirements of this research design. The data collection methods and justification are discussed below.

### 4.4.1 *The educational technology sandpit data collection*

The data informing this reflection which stemmed from several sources is presented in the diagram below.

	By Researcher	By Researcher	Researcher & Participants	Participants
Data collection	Workshop photos	Observations - journal	Workshop materials	
	Workshop Videos	Experiences / Interventions		Project artifacts
Written / audio materials			Workshop reflections	Post Workshop Interviews
				Post Workshop Surveys

←
→

← During the workshop → After the workshop →

Figure 27: Data sources for the ETILAB sandpit

### i. During the workshop

In accordance with the DBR paradigm, lived experience of educators/researchers comprised the main data informing the study. The data was collected using the various formats as indicated in Figure 29 above. As the researcher, I was not just an observer but rather actively participated in and facilitated the workshops. According to Yin (1989), the researcher may take on a variety of roles during a study and may even participate in the event under study. My role as a designer of the programme was to facilitate and lead but also to work closely with the practitioner to discuss, modify and re-design as we saw fit during the process. At the workshops, I photographed and video recorded the participants and their presentations and, each stage of the process. I also recorded real time observations as the process unfolded. As I worked with the practitioner and re-designed the programme, I captured all the changes and modifications, ideas for future workshops and points at which the students appeared to be struggling. All of this material informed the study findings as a reminder of the lived experiences.

In addition to the journaling and personal observations, I also recorded the practitioners' comments in my journals and made an audio recording of the reflections of the students as the process unfolded. Workshop materials, presentations, artefacts and photographs were also collected to inform the study.

## ii. After the workshop

Three pieces of information were collected after the workshop, namely, the project artefacts themselves as well as two sources of information from the participants to further understand their experiences of the journey they had just undertaken.

### **Post workshop interviews**

Semi- structured interviews are another tool used in inquiry (Fetterman, 1988). These interviews took the form of a dialogue or interaction and constituted a conversation with a purpose. The semi-structured interviews were guided by a set of basic questions and the issues to be explored although neither the exact wording nor the order of the questions was predetermined (Erlandson, 1993). The questions asked were open-ended to allow the volunteers to respond in any way they deemed appropriate. The interviewer's role in both the process and the interpretation of the information was included and acknowledged. Listening to the participants and exploring the meanings of what they had to say were of the utmost importance. With the permission of the participants the interviews were videotaped to ensure that the data was captured more faithfully after the interviews than may otherwise have been the case. This also allowed me to focus my attention on the interview and not on hurried note keeping.

### **Post-workshop survey**

A follow-up survey was administered approximately one week after the workshop. This survey was conducted online using the online course management system. All the survey responses are anonymous. The responses are presented in Appendix 8 and were used during the data analysis process.



#### 4.4.2 Educational multidisciplinary sandpits data collection

As Indicated in chapter 3, the second iteration was the African Science Leadership Programme (ASLP). The diagram below is a graphical depiction of the data collection sources used during the workshop.

	By Researcher	By Researcher	Researcher & Participants	Participants
Data collection	Workshop photos	Observations - journal	Workshop materials	Project artifacts
		Experiences / Interventions		Interview Videos
Written / audio materials			Workshop reflections	Post Workshop Surveys

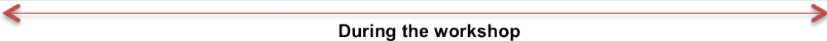
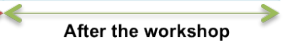



Figure 28: ASLP Data collection

##### i. During the workshop

The entry into this workshop was different from that of the previous workshop as, this time, there was an established process and an enhanced solution and the aim was to test the use of this enhanced solution in a real-life setting. The same materials were collected as during the first iteration, except the whole event was not video recorded. The journaling and personal observations were given special attention and informed the majority of the data collection. The workshop material, presentations, artefacts and photographs were also collected to inform the study.

##### ii. After the workshop

Three pieces of information were collected after the workshop, namely, the project artefacts and two sources of information from the participants to further understand their experiences in the journey they had just undertaken. This was done through an online survey and interviews.

## 4.5 DATA ANALYSIS

*“For novices, data analysis is probably the most mysterious aspect of qualitative analysis”  
(Maxwell, 2005).*

Qualitative research is a research methodology that focuses on an in-depth understanding of the behaviour of humans and the motivations that govern human behaviour. In short, this research method investigates how and why individuals and groups understand or view the world around them.

As noted above, a significant amount of data was collected. At the end of the first iterations, I had collected over 30 GIG of data from all the data sources mentioned above. I was overwhelmed by the data. I had to handle my excitement at having gone through this process with the educators and seeing the overwhelming results I had obtained. I then had to sift through the data carefully to decide how I could come up with a compelling story that was suited to my thesis. This process was both painful and overwhelming and I had to take several breaks during the research process to decide how I could navigate the complexity of creating a story from the multiple sources leading to a contribution of this study. Several writers and concepts helped to guide me through this problem. In Page 17 and 18, I mention how the color coding of texts from the various sources, which helped to identify the various sources of the data collected in the study.

### 4.5.1 Reflexivity

Watt (2007) maintains that each project is unique and that, ultimately, it is up to the individual to determine what works best in the context of the project concerned. In view of the fact that the researcher is the primary “instrument” in the data collection and data analysis processes, reflexivity is deemed to be essential (Glesne & Peshkin, 1999; Stake, 1995). Experts contend that it is through reflection, researchers become aware of what enables them to see as well as what may inhibit their seeing (Russell & Kelly, 2002). This entails a careful consideration of the phenomenon under study as well as the ways in which a researcher’s own assumptions and behaviour may impact on the

inquiry. Although this was convincing on a theoretical level, as a new researcher I had little idea of what it meant in concrete terms.

Hermeneutic phenomenology arises from the observer's experiences, pre-suppositions and projections of his/her personal values and expectations. Our actions may influence both our conscious and our unconscious minds, while our perceptions are based on our past experiences, culture, tradition, social environment and self-identity.

A number of experts (e.g. Glesne & Peshkin, 1992; Maxwell, 1996, 2005; Spradley, 1979) recommend writing short notes or memos, to oneself during the entire research project. They maintain this is extremely beneficial and point out that recording ideas when they arise is actually the beginning of analysis. Writing notes to themselves enables researchers to discover ideas of which they were not even aware (Elbow, 1995).

Hence, I made use of my research journal throughout the process and, then, when watching the video clips, I was able to identify areas during the workshops where I intervened and effected changes as well as the reasons for the changes and recommendations for the future.

The next section discusses the data reduction process that assisted me in dealing with the data from the video materials, survey materials and audio recordings of the reflections of the participants.

#### 4.5.2 Data reduction

I adopted Denzin and Lincoln's (1998) methodology for data reduction in order to make sense of the data and to guide the process of data analysis. The first step involved classifying the raw data – a process that involved breaking down the data into meaningful parts and then bringing it together again in a way that made sense. Classifying data is an integral component of the data analysis process. It lays the conceptual foundation upon which the researcher makes interpretations and explains phenomena. It was, therefore essential to reduce the data in an anticipatory way and to

choose suitable instruments to do this, namely, a conceptual framework and questions. To date there is no consensus on the analysis of qualitative data (Creswell, 1998).

Although there are guidelines in the literature, the qualitative paradigm's emphasis on interpretation and emergent design provides no precise formulae on how to proceed. Each project is unique and, ultimately, it is up to the individual to determine what works best. Since the researcher is the primary "instrument" of data collection and data analysis, reflexivity is deemed to be essential (Russell & Kelly, 2002). Experts contend that it is through reflection that researchers may become aware of what enables them to see as well as what may inhibit their seeing (Russell & Kelly, 2002).

There have at least been methods of analysis developed in this particular form of research strategy (Creswell, 1997; Firestone & Dawson, 1988). According to Watt (2007), although there are guidelines given in the literature, each project is unique and, ultimately, each individual researcher must determine how best to proceed. There are few fixed formulae or recipes to guide the researcher. Thus, data analysis is "custom built" as qualitative researchers "learn by doing" (Creswell, 1997, p. 142). Much depends on the investigator's rigorous thinking as well as the presentation of sufficient evidence and careful consideration of alternative interpretations (Yin, 1989).

The aim of the data analysis is to treat the evidence fairly, thus producing compelling and analytical conclusions (Creswell, 1997). The data involved appears in the form of words rather than in numbers (Miles & Huberman, 1994). It involves the systematic examination of something in order to determine its parts, the relationship between these parts and their relation to the whole. However, it is possible to achieve this end in more than one way (Spradley, 1979).

Although there is no consensus regarding the analysis of qualitative data, there are common features to be found in the suggestions of various writers. For example, a general overview of all information is recommended. Detailed descriptions are initially gleaned from the participants and the words used by the participants are analysed. The material is then reduced by classifying it into themes or

dimensions using coding (Creswell, 1997). One characteristic of qualitative data analysis is that the analysis moves in analytical circles rather than in a linear progression.

In the main, the study followed the steps discussed below although, in reality, the process did not progress in an orderly, step-wise fashion (Blanche & Kelly, 1999)

#### **4.5.3 Familiarisation and immersion**

The data collected consisted of video interviews from the entire week of the workshop, video recordings of all the interviews with the participants, audio recordings of reflections, survey data collected online and, finally, the project artefacts from the workshops as well as the researcher's own personal journal. All these formed the basis for the data analysis. The videotapes were watched repeatedly in order to make decision on which of the data was relevant for the study in terms of the research questions to be addressed. The relevant parts of the data required was then transcribed while the researcher listened to it again. By the end of this stage pages of data had been collected.

#### **4.5.4 Introducing themes**

The process of introducing themes is inductive in that general rules are inferred from specific instances. The organising principles that underlie the material are identified (Blanche & Kelly, 1999). The themes selected reflect the interest and focus of the study in question (Rubin & Rubin, 2011).

#### **4.5.5 Evaluation**

During the evaluation stage, the material was examined and re-examined until it was decided that the account given of the participants' experiences was satisfactory. This process was continued in light of the themes that had emerged until different sub-issues came to light

(Terre Blanche & Kelly, 1999). As the data was reviewed and re-reviewed new themes emerged. Each time new themes were added I went back to the interviews to mark off these concepts, themes and ideas. (Creswell, 1997; Rubin & Rubin, 1995).

Spradley (1979) echoes this by claiming that qualitative research does not involve sequential steps in analysing the data but, rather, it requires constant feedback from one stage to another. Although it is possible to identify steps they all take place simultaneously.

When I finished with this process, I would then come up with a story to narrate the research outcomes using the themes that had emerged (Terre Blanche & Kelly, 1999). These themes all spoke to the various aspects of the project artistry framework.

#### 4.6 Chapter 4 summary

This chapter discussed the adoption of DBR as the methodology that guided this study. The chapter also contained a justification for the use of this methodology. It then discussed the various stages of DBR in the context of the thesis. The chapter then discussed the data collection methods used in the study as well as the data analysis process used. The next chapter on the data analysis provides a detailed discussion of the observations, the outcomes impact of each phase of DBR and all the learnings from the applications in the study.

## Chapter 5: Research Analysis

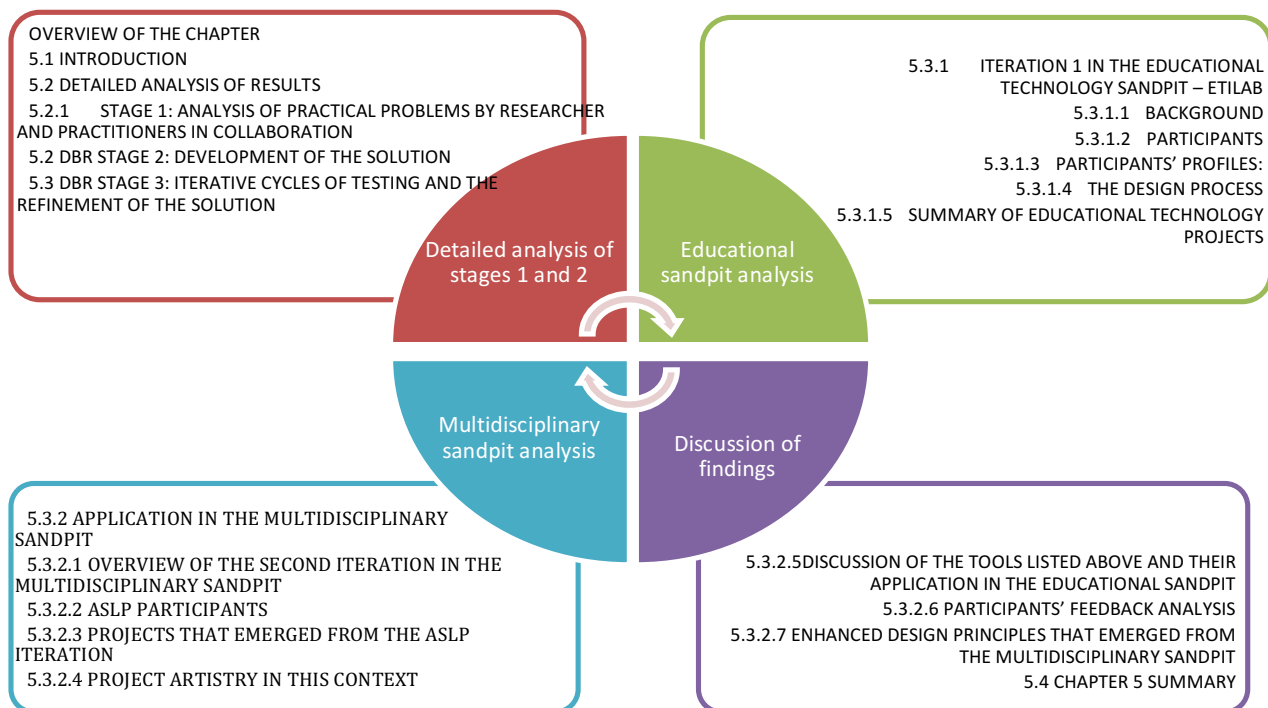
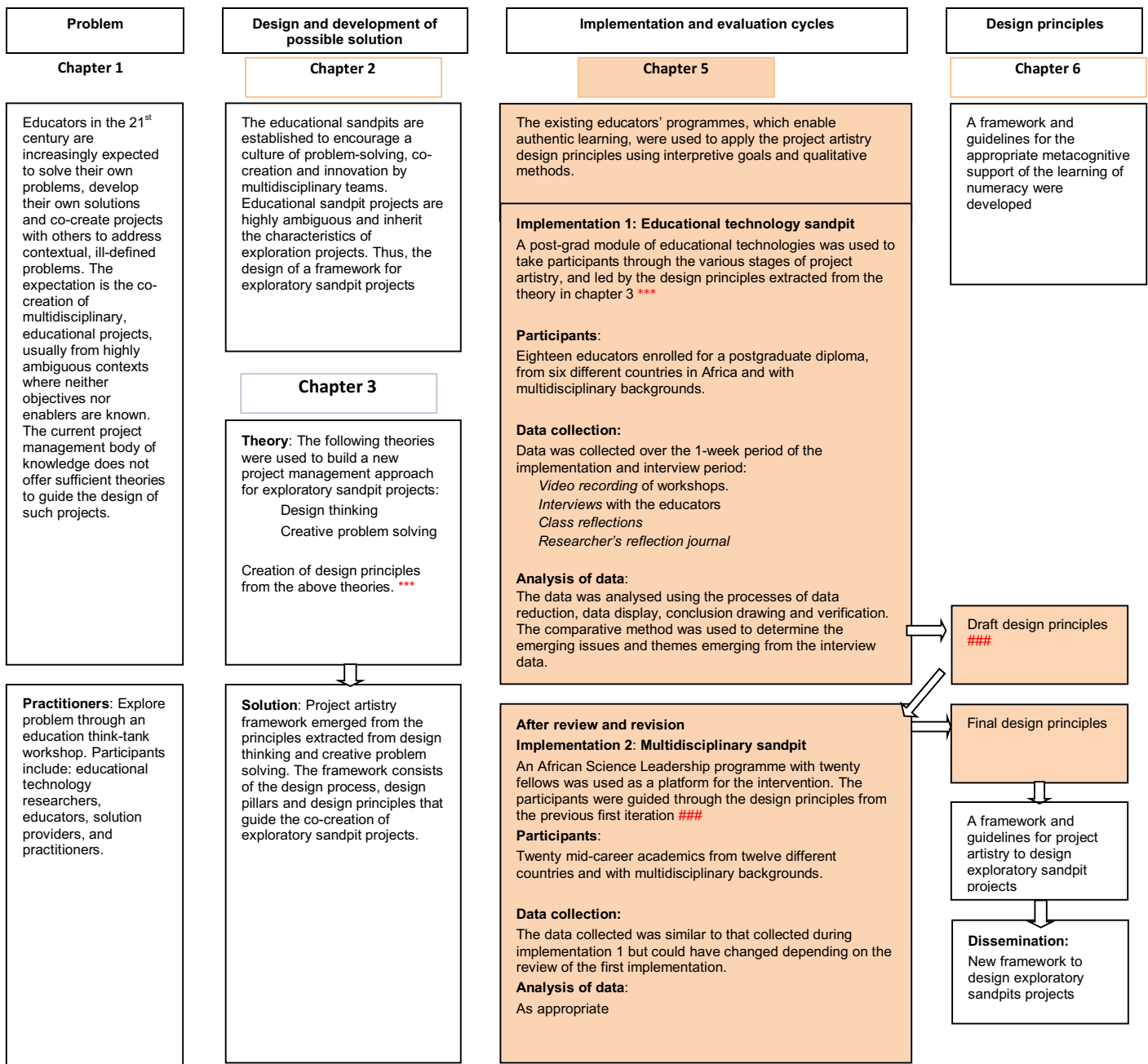


Figure 29: Overview of Chapter 5

## Chapter 5 - Research analysis highlighted in the context of the entire study



(Adapted from Reeves (2006, p. 59))



## Overview of the chapter

The previous chapter presented a justification for the research methodology selected in the context of the research problem and relevant literature. It also described the processes used to gather, interpret and analyse the data. This chapter discusses the patterns of the themes that emerged from the data which had been collected. In many cases, the participants are quoted verbatim. Readers should note that these quotes are presented in orange textboxes. I insert my own remarks as the researcher's remarks or comments from my journal, these are presented in purple textbox, with italic style. The practitioner's comments are presented in blue textbox. The research findings led to a number of emerging themes. In addition, this chapter also discussed project artistry principles in the light of the new insight generated from the empirical input.

### 5.1 Introduction

*"For novices, data analysis is probably the most mysterious aspect of qualitative analysis" (Maxwell, 2005).*

As highlighted in the quote above the data analysis phase of this research journey was certainly the most mysterious part of the journey. I felt overwhelmed by all the data from the workshops, from the post workshop surveys, from my journals and from the practitioner's comments. In addition, the data was also in different formats, namely, videos, audio, online survey results and physical artefacts from class.

Watt (2007) maintains that learning how to conduct qualitative research may seem daunting for those new to the task, especially in view of the paradigm's emphasis on complexity and emergent design. Although there are guidelines presented in the literature, each project is unique and, ultimately, the individual researcher must determine how best to proceed.

I then revisited the main research question, namely; *How to facilitate an enabling project environment that stimulates creativity and encourages co-creation in exploration projects?"*.

The following sub questions then emerged from the overarching research question cited above:

- 1. What are the design thinking and creative problem-solving principles that may enrich the process of vision creation and conceptualisation in exploration projects?*
- 2. How may the emerging design principles be enhanced through experiments to ensure a more practical framework for managing exploration projects?*

The first research sub questions in 1 above required an exploratory study on design thinking and creating problem solving. Chapter 2 provided a background to these phenomena and how they may be applied to exploration projects. The concept of project artistry then emerged from this exploration. This concept was then proposed as a framework that could be used to navigate the complexity of exploration projects in order to bring about greater clarity on the objectives of exploration projects and means to achieve these objectives.

The proposed project artistry framework is then tested in the education field using DBR methodology. The methodology included the following four steps or phases: 1) defining the problem with practitioners in the field of study, 2) developing a solution to the problem, 3) iterations in a natural setting to test the proposed solutions, and 4) documenting the recommendations pertaining to the enhanced design principles based on the iterations carried out in 3). The next section discusses each of these phases carried out, the data analysis in each phase and the results and outcomes leading to the enhanced design principles.

Section 5.3 discusses the themes that emerged from the post-workshop surveys and interviews that were conducted with the participants in both iterations. This led the pillars of projects artistry and recommendations as contained in the application of this framework.

## 5.2 Detailed analysis of results

DBR was used as the methodology in this inquiry. This section discusses the findings from each stage, the data analysis carried out in each phase and how the findings from one stage affected the next phase. The aim of the empirical test was to test the phenomena highlighted in Chapter 2 within the context of the educational sandpits. Chapter 3 explained why this context was deemed to be appropriate as a testing platform for the purposes of this thesis.

The analysis of the problem in stage 1 of DBR is discussed as to how I worked in collaboration with practitioners to identify and analyse practical problems in their context. I then discuss how I developed design solutions as an intervention in respect of the existing problem in stage 2. This was followed by iterative cycles of testing and refinement in stage 3, which led to the enhanced solution discussed in the next section. Figure 32 below presents a graphical depiction of the way in which DBR was adopted. The figure also presents the flow of this section based on the stages.

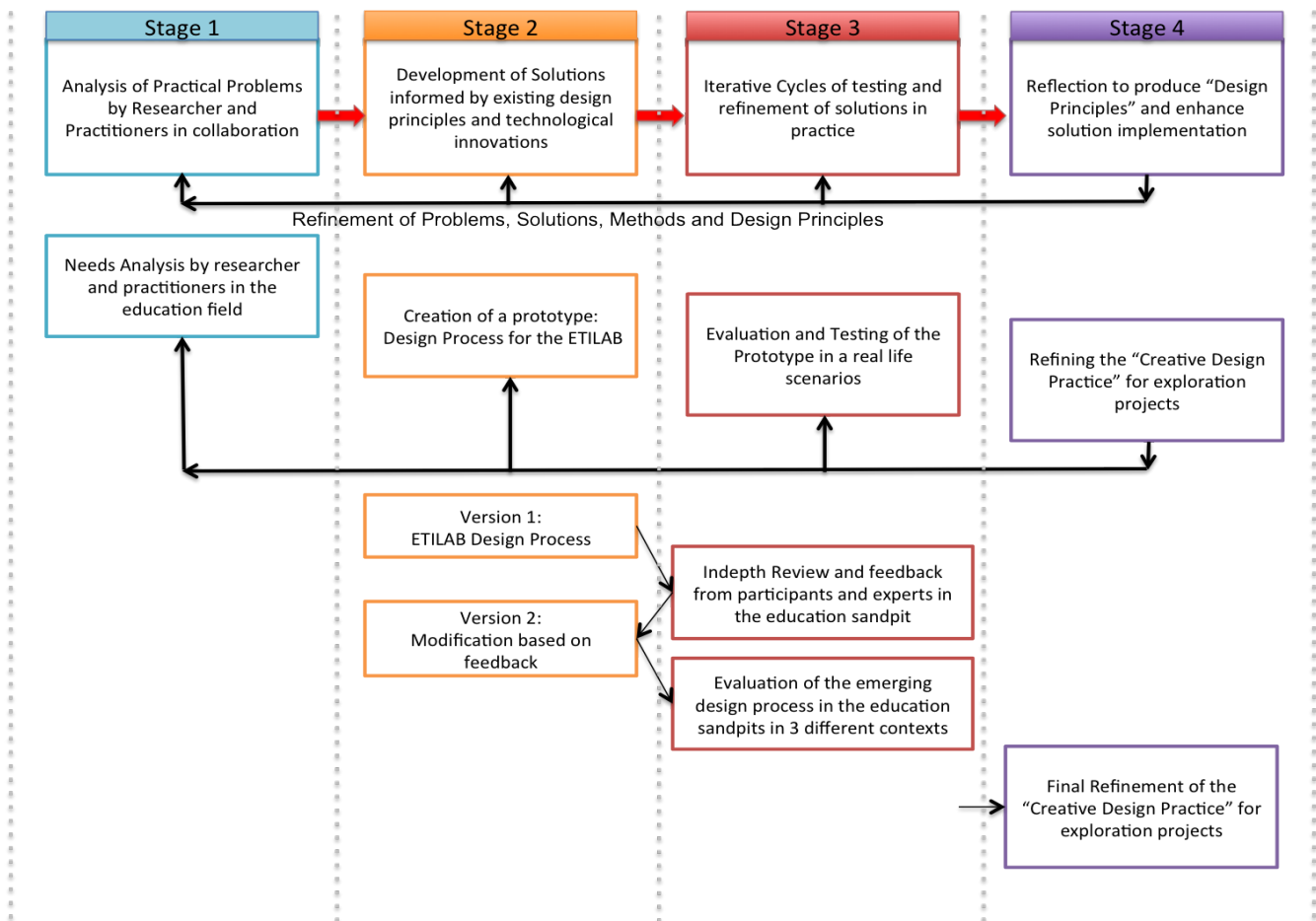


Figure 30: Design-based research: Application in this thesis

### 5.2.1 Stage 1: Analysis of practical problems by researcher and practitioners in collaboration

#### Background:

As explained in Chapter 4, the first stage in research-based design is an extremely engaging stage and involved both the researcher and the practitioners unveiling and exploring the problem situation. Depending on the problem at hand and the complexity of the situation, this may be a time-consuming exercise which involves probing questions, creating an atmosphere of brainstorming and entering the world of the practitioners to understand the problem clearly. This is very similar to the first step of the design thinking process that involves empathising and seeing the world from the user's perspective and then using this lens to define a problem.

*\* Given the fact that I have worked in the educational technology space for over a decade it was important for me to address my own biases and prejudices regarding the research topic, to find relevant practitioners and then to create an atmosphere that would allow them to contribute and analyse the problem situation.*

My experience as a design-thinking practitioner for over seven years enabled me not only to understand this stage but also to respect it as an extremely critical stage in to the process. First, I had to identify who the real practitioners in this field were and then guide them through a process to analyse the problem situation carefully and agree on the problem was key to this entire thesis.

### **The think tank workshop**

#### **Objective:**

The objective of the think tank workshop was to gather all the relevant stakeholders and experts in the education field together so as brainstorm problems and issues relating to education in South Africa.

#### **Participants:**

There were 30 participants. They included representatives from corporates that specialised in educational technology, schoolteachers, researchers in the education field, Intel and several other stakeholders.

#### **Facilitators:**

The people identified above were invited to discuss, debate, brainstorm and analyse problems in the education field in the African context. I co-facilitated the session with the field practitioners to guide the full day workshop to uncovering underlying problems in education.

The day entailed an introduction to the education sandpit concept. The rest of the day was then spent

in engaging with tools from the design thinking process. This helped to create an atmosphere of openness and acceptance, thus ensuring that each participant contributed and that each individual expressed his/her own ideas as the very diverse group represented diverse insights, perspectives and interests. It was important to ensure that the various sessions were conducted in a manner that allowed contributions from each person present as well as the capturing of all these ideas. Some of the participants were asked to present their worldviews with regard to education in South Africa in order to ensure different perspectives on the subject.

*\* My role differed from that of my fellow facilitators as they were able to contribute to and direct the conversations, while I, as a researcher in the field, had to step back, collect data and ask probing questions that would elicit as many insights as possible on the subject. However, as a design-thinking practitioner, I was also responsible for creating an environment that allowed for imagination, intuition and openness.*

### **The methodology**

The whole day workshop resulted in worldviews being expressed by learners, educators, technology experts, education researchers, technology companies, school representatives and many other stakeholders. The sessions included the following two main components:

- i. Current problems in the field of education
- ii. Future classroom themes using imagination

#### **I. Current problems in education:**

The literature suggests we should be future-oriented and adaptable and that we adopt a more complex view of knowledge that incorporates knowing, doing, and being. In addition, we need to rethink our ideas on how our learning systems are organised, resourced and supported.

The discussion was based on the Didactic Triangle. According to Hudson (2002), the triadic relation of teacher, student(s) and subject matter is intended as an invitation and not to reduce the complexity of

the didactic situation. He goes further to suggest that the triad may be seen to offer tools that help to sharpen the focus in the analysis of all teaching-studying-learning processes (Hudson 2002). The students' cognitive and moral development and the teachers' professionalism depend on each another and, in addition, the subject matter has to be considered in relation to teachers and students. The diagram below is a graphical depiction of this phenomena and formed the basis of the discussions at the think tank workshop.

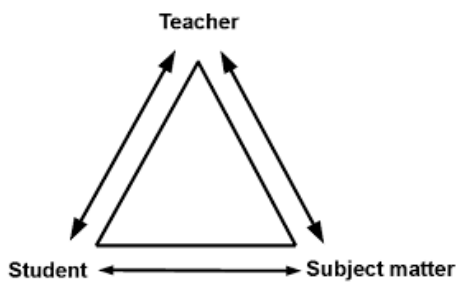


Figure 31: Didactic triangle

Based on this model a discussion was held on how this model compares to the everyday teacher/educator reality. The challenges and consequences are summarised below:

#### **Challenges:**

- Inspire teachers to achieve competencies
- Delivery to teachers who lack education transformation skills

#### **Consequences:**

- Create a space in which to safely address this issue
- Project based learning vs. teacher presentation

The discussions also resulted in the conclusion that the teacher was at the heart of the problem with there being general feedback that content was not a problem and neither were the students but that teacher-to-teacher interaction was necessary for deep learning and to build a community of support, teacher networks, experts and peers.

The discussion on education and the problems raised culminated in the figure 33 below that was drawn and refined during the discussions. The triangle was then rethought around the teacher. Both indirect and direct influencers of learning were identified. Indirect influencers were identified as technology, infrastructure and change management, whereas the direct influencers were identified as pedagogy, learner issues and teacher issues.

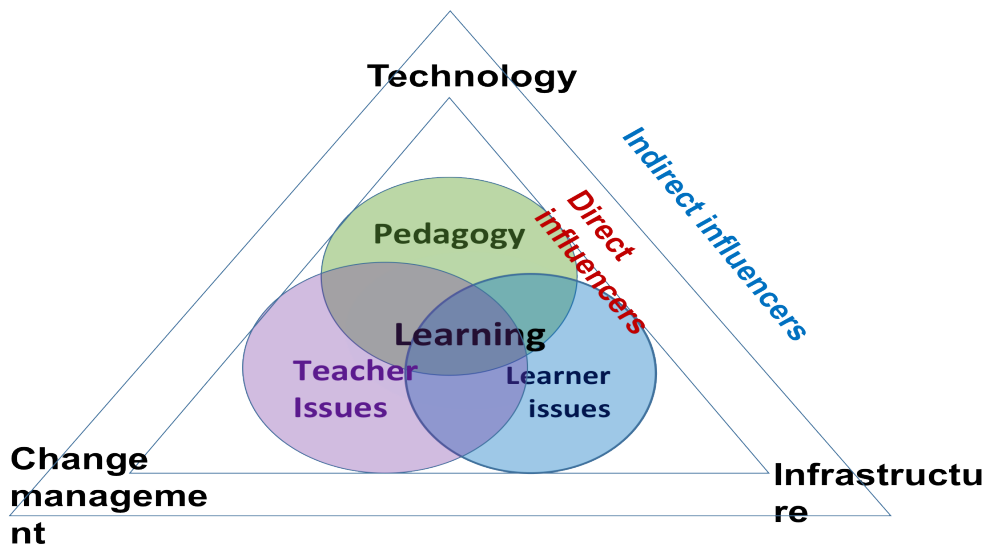


Figure 32: Learning problems identified by think tank in South Africa (2014)

### Conclusion on the educational challenges:

In concluding this section on challenges in the education field, it was agreed that the educator is the main intervention point, as well as directly influencing everything in the learning system. Many aspects regarding the educator were identified and are summarised in the mind map in figure 34 in page 171. The next section describes further discussions on the educator based on imagining the educator in 2030.



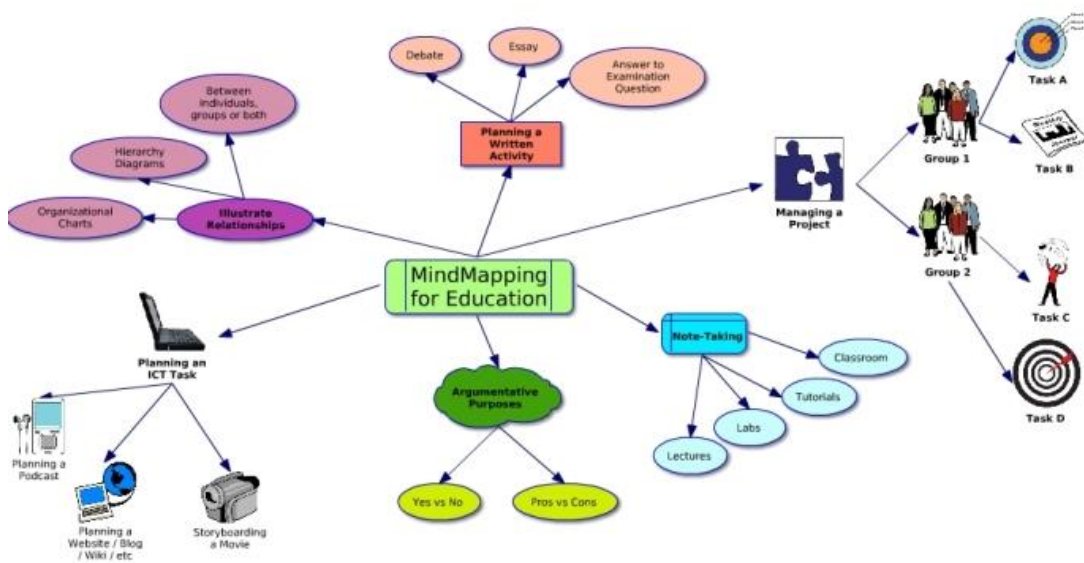


Figure 33: A mind map emerging from the think tank workshop

### iii. Future classroom themes using imagination

The think tank participants were divided into four groups and asked to imagine the ideal educator of the future. The session was facilitated using the creative problem-solving tools of brainstorming. Thus, the participants were taken to a place of imagination and ideation using exercises that encourage the suspending of judgement and exploration. The groups were asked to think about the educators of 2030 and how they would look if there were no resource constraints and the current problems had all been solved. After thirty minutes, the groups were each asked to give a presentation of their conceptualisation of the educator of 2030.

The following four themes emerged from these presentations, namely:

- Group 1: Life coach
- Group2: Learning managers and learning expert
- Group 3: Big data teacher
- Group4: Valued, motivated teacher

In summary, group 1 expected the educator of 2030 to be a well-rounded, life coach with a holistic

approach to learning and possessing strong leadership skills as well as strong technical skills. These educators would be empowered to develop their own solutions to ensure continuous interactions with students, collaboration with other teachers in order to draw on each other's strengths and create a community of learning. Group 2 indicated that the educator of 2030 would be responsible for individualised learning platforms, they would use technology to manage the learning process and optimise the students' learning through technology-enriched, experimental laboratory settings, teacher portals and growing, professional learning communities. Group 3 maintained that the big data teacher would be a micro-chipped educator, connected to big data and downloading to learners with google glasses and other connected digital devices. For group 4, this value motivated educator would be a well-respected, highly paid, well equipped educator who guided learners toward generating, and not consuming, knowledge.

### **Conclusion regarding the future educator:**

This session culminated in one conclusion regarding the problem with education in the context of emerging economies. Because of resource constraints, time pressures, varying contexts and the rapid speed of change, educators have to play more than just the one role of the pedagogue as they are also called to be ***implementers, problem solvers, project managers and the developers of solutions to the problems in their environment***. They have to take ownership of their own problems, develop their own solutions and engage their minds in problem solving as well as the development of educational products.

This led into the next phase in the development of the solution or intervention.

## 5.2 DBR Stage 2: Development of the solution

This second stage involved the development of the solution or intervention regarding the problem in education. It had become apparent from stage one above that the key problems in the research context, as discussed in Chapter 3 of the study, are both relevant and ongoing. There was an underlying need for educators to possess strong problem-solving skills, unleash their creativity and collaborate in the co-creation that is at the core of the education field. Educational sandpits had emerged as new concepts in Africa to empower educators to initiate, develop and implement their own educational solutions.

Chapter 3 highlighted that educational sandpit projects are *exploration projects* characterised by high levels of ambiguity and uncertainty. Chapter 2 discussed the knowledge gap in project management and the emergence of design thinking, which incorporated the rich principles, processes and mind-sets that could address the knowledge gap in project management gap. I had suggested the project artistry framework that embodied design principles that would guide exploration projects.

## 5.3 DBR Stage 3: Iterative cycles of testing and the refinement of the solution

This section discusses the findings and the analysis related to the application of applying this model in the education field as an intervention to address the problems identified in the previous section. In Chapter 3, I justified the context of educational sandpits as exploration projects. I highlighted similarities between sandpit projects and exploration projects while, in Chapter 4; I justified the use of educational sandpit concepts to address the problems identified in stage 1 of the DBR. I then tested this thesis in the educational sandpits space. The two iterations took place, firstly, in the educational technology sandpits space and, secondly, in the educational trans-disciplinary sandpits space.

Having established this link, I now report on the findings and analysis of the application of the project artistry model in the educational sandpit projects.

### 5.3.1 Iteration 1 in the educational technology sandpit – ETILAB

#### 5.3.1.1 Background

Chapter 4 elaborated on the research methodology adopted in this thesis, the testing of the ETILAB process which had emerged from stage two through the educational technology programme. The participants were divided into six groups which all then worked on real life problems faces in the education field. The groups were paired, with one group playing a client role while the other playing the supplier role and vice-versa. Using the guided ETILAB process the problems that emerged were then framed into opportunities in order to design mobile applications to address these problems. Each step in the process was followed until an artefact was developed and demonstrated to the client. The feedback was then incorporated into the final product that was presented on the last day of the workshop.

The setting used was a natural setting in which the participants were not informed about either the process or the assignment. Instead, they were guided through the ETILAB design process daily with through each stage of the process. While this was happening, the researcher was journaling and reflecting with the practitioner who was observing the process. Both the researcher and the practitioner were involved in the process of reflection and in redesigning the setting and the leadership as various aspects emerged. This section explains the details of the iteration.

#### 5.3.1.2 Participants

- There were 18 participants
- The participants were from 5 African countries: *South Africa, Congo, Zambia, Uganda and Namibia*
- The participants included professionals, educators, government, e-learning managers, policy makers and instructional designers in the education field
- The participants had no background in either programming or app development

### 5.3.1.3 Participants' Profiles:

The profiles of the educators who participated in this research can be obtained from Appendix 2.

### 5.3.1.4 The design process

#### a. Entry into the process:

As depicted in Figure 30 in Chapter 4, the diverse team of people who came together had not known each other prior to meeting. However, they had gathered together for a purpose. A gap had been identified in African academia, namely, that there was a lack of leadership acumen in the faculty chosen to attempt to develop such acumen.

As reflected in the table above, a diverse team was chosen. This diversity was reflected in terms of disciplines, gender and countries of origin, as the aim of the meeting was to conceive multidisciplinary leadership projects in the context of the African continent.

#### b. The process

The design process followed was closely aligned with the design process as depicted in Figure 4. Each phase lasted a day while the final day was devoted to project presentations and the development of project teams.

#### c. Exit from the process

The process culminated in a set of multidisciplinary leadership projects with well-defined project concepts and project teams. These teams were engaged and excited about taking these projects forward to implementation. These are discussed in the next sections.

#### d. Design principles

The project artistry design principles, which emerged from the literature review and which were presented in Table 10 in Chapter 3, were applied in this thesis in order to refine them further.

##### 5.3.1.5 Summary of educational technology projects

This section explains the six iterations of the process: for each group, the original research problem is stated, the way in which the problem was framed into an opportunity is discussed and a description given of the prototype. In addition, the comments of the client are quoted and the lessons learned from each group discussed can be found in Appendix 5, which is a summary of the project outcomes.

The various iterations of the design process in the ETILAB resulted in interesting observations, feedback and experiences that in turn led to rethinking some of the aspects of the ETILAB design process. They also revealed some aspects about design thinking that had not previously been considered, for example the social-cultural issues that impact significantly on the creative phases of the design process. The need for the creative problem-solving process to be incorporated into each phase to enable an environment that is creative, less judgemental, free and yet orderly and clear on the rules for diverging and converging in the various stages of the process were highlighted. A number of the observations that encouraged the depth and modification of the ETILAB design process are discussed below.

#### *2. Summary of reflections of both the practitioner and the researcher on each stage of the process:*

The inherent creative culture encouraged in the ETILAB process demands an atmosphere that inspires creativity and a space in which each participant may contribute. Project meetings usually involve a few extroverts or empowered individuals who share their thoughts without regard for those less empowered or introverted than they are.

It became very important to start each session with a short activity that went beyond ice breaking but

which actually took the participants into a creative space and re-enforced that notion of treating one another as “thinking equals” (Kline, 1999). There were also inherent social cultural issues that needed to be addressed to ensure that all the participants felt free to ideate and realised that their contributions would be valued. Several of the observations and the wisdom from each stage are indicated below.

## 1. Empathy

***“Empathy is the centrepiece of a human-centred design process”  
(Kelly, 2008).***

The concept of the ETILAB was generated in empathy with educators who often feel pressurised to use technology in their teaching despite the fact that there is little investment made in empowering them to use the technology and ensuring that they feel confident in using the tools.

Thus, educators often find themselves in a difficult space where they are competent in their disciplines but not equally confident in the technology tools they could be using to support their pedagogy. Some of the major obstacles in using technology include fear as well as a reluctance to make mistakes and to look like “an idiot” in front of participants when using technology. This fear is often expressed in forums where they come together and talk openly about their experiences.

The ETILAB was designed for the educators as a safe space in which to experiment, to play and to co-create with others. Thus, each artefact was developed from a place of empathy where there was identification with the user, a deep understanding of the user and a sharing of their pain.

The ability to work so closely with the users that the project crafter/facilitator ensures that the educators move from a problem situation to a place of ownership of the problem in question as well as co-creation with the project teams in reaching a creative solution together. This involves taking the user through a journey of seeing a problem as an opportunity, being introspective about the problem, gaining a different perspective of the problem and feeling empowered to co-create a solution with the

project team. The comments of the participants in both the empirical situations clearly indicated that incorporating empathy in the problem-solving situation allowed openness to user participation and input. This resulted in the solution providers walking a selfless journey with the users and also one that capitalised on the users' experience and input and ensured co-creation and empowerment by users in that they are part of the problem solving.

The practitioner echoed this when he stated:

\* *"Empathy allows the user to be introspective about the problem, to see it using a different lens and, therefore, becoming part of the solution creation".*

One of the comments from the participant provided below pointed to a new understanding of empathy, the ability to forget one's own experiences and subjective thoughts about a subject matter and, instead, to focus on another person's problem and seek to see the situation from that person's perspective:

- ❖ *"I have learned to offer a gift of active listening and seeking to see the world from other people's perspective".*
- ❖ *"When you want solve a problem be in the shoes of that person – that's how you can solve the problem".*

The design thinking principle of empathy encourages the use of observation, gaining insights and seeking a deep, human understanding of what customers want. This entails seeking to walk in their shoes, validating assumptions, asking penetrating questions, deep listening, connecting emotionally and empathising with the customers. This is not the same as conducting a project requirements process, interviewing stakeholders or conducting project focus groups or surveys. On the contrary, it involves insightful observation, living in the customers' world, experiencing their perspectives and seeking to co-create with them in designing and delivering what they require. It is ironical that



projects rely on classic scope definition and requirements gathering processes that are often static, cursory, and rely heavily on documentation (Duggal, 2010). Design thinking understands that it is often difficult for people to articulate what they want and, hence, project artistry proposes that the project team observes, engages and empathises in order to gain insights and allow the people concerned to see their problem through different lenses.

Inherent in the process of seeing the world from the user's perspective is the ability to empower the user to feel a part of the problem-solving situation to a point at which the user does feel that there is a divide between the problem-solving agents and themselves. This is because the project is conducted in such a way that the users are a part of both the problem-solving process and the project team and they are expected to contribute everything they know about the project.

## 2. Think

***“Problems are half-solved if properly stated” (Mark Twain).***

The outcome of the think stage is a clear problem statement that provides focus and reframes the problem into a redefined challenge that invites solution and stimulates new thinking.

The natural tendency to start thinking about the solutions before engaging deeply with the problem is a key challenge of this stage. This stage invites the participants to apply their minds deliberately to the problems and to seek to understand the roots of the problem through probing and engagement – to seek to define the problem in a better way through identifying with the user while applying the mind to the problem definition.

### Summary of journal reflections on the “thinking” stage

- *Adjust one's own preconception in the light of the new perspective*
- *Allow the client to refocus, using a different lens through which to view the problem*

- *Co-creating and co-focusing is likely to generate a brand a new definition of the problem*
- *Allowing both the client and the provider to unravel both the problems and their symptoms*
- *Beware of socio-cultural norms and seek a safe brainstorming space*
- *Be extremely sensitive to context*

### 3. Ideate

***“The best way to have a good idea is to have lots of ideas” (Linus Pauling).***

Once the problem has been clearly defined in the step discussed above, it becomes necessary to brainstorm ideas on how to address or solve the problem that has been identified. This step allows users and providers the opportunity to diverge on every possible solution with the aim of eventually converging to a more feasible, desirable and viable solution. The ideation phase is critical in facilitating an exploration of the solution exploration and allowing the emergence of various ideas, building on another's idea and seeking wild and “crazy” ideas with the purpose of generating innovative solutions.

It was found to be of paramount importance that the participants engaging in brainstorming about the solutions to felt empowered and that this was not automatic. The participants often come from a context where they were not empowered as a result of the socio-cultural norms in terms of which people are accorded privileges because of education, class, age, gender, race, etc. According to Kline (1999), it is important in ideation that all the participants are treated as thinking-equals. The following principles are useful in empowering all the participants and in creating this safe ideation space.

#### **Guidelines emerging from the journal reflections with the practitioner**

- *Avoid dominance*
- *Beware of subjectivity*

- *Use tools that may help in the gathering of ideas such as the brainstorming technique of diverging and converging. Be clear on the rules*
- *It may be necessary to use technology e.g. polleverywhere.com to facilitate the generation of ideas.*

#### 4. Learn

***“Through learning we-create ourselves. Through learning we become able to do something we never were able to do” (Peter Senge).***

Learning is critical in technology projects as the world of technology is extremely volatile and, thus, it is continuously changing. It is important to ensure that there is a willingness and eagerness to learn new technologies, new languages, and new ways of thinking, brainstorming and the new processes that facilitate innovation. In addition, the learning about the problem (see previous steps) and learning about the various solutions proposed become key to the success of projects. This culture of learning is stimulated through an openness and a willingness to embrace the ethos of experiential learning in an environment in which it is safe to make mistakes, learn from these mistakes and expand the existing knowledge boundaries. A culture of learning is critical if one seeks novelty in projects.

Journal reflections on the learning stage

- *Willingness to learn from the client about the problem and then approach the problem with an open heart, seeking to remove prejudices and biases.*
- *if the artefact is technical, ensure that it is technically feasible. The team may need to acquire a new skill to develop a solution that addresses the problem.*

#### 5. Act

***“Creativity requires the courage to let go of certainties” (Erich Fromm).***

It takes courage to act on decisions made in the previous steps. However, the ETILAB is a space of action, where things happen and thoughts are converted into reality. It is a space that espouses the view that there is a homegrown solution to all education challenges that just needs to be uncovered. The first step in this process of innovativeness is to act. Thus, co-creation is at the heart of design thinking. In addition, the ability for a team to make decisions (i.e. act) and then perform the tasks necessary to make the artefact a reality is vitally important.

This step requires the boldness to develop the idea into an artefact/prototype that can be tested

It is important not to spend a long time before people see the product as people want to see an artefact quickly. This empowers, excites and energises them and also gives them confidence in the process. This becomes extremely empowering if the users are an integral part of the solutions

Journal reflections on the act stage

- *Allow users to touch and feel*
- *Give them the power to comment early in the process*
- *HONESTY and TRUST*
- *Do not underestimate the intelligence of the user*
- *Assume they are rational and they may be critical*
- *In the African context, “if people feel marginalised, they may not tell you but simply not use your product”.*
- *The element of co-creation inherent in design thinking removes the fear of voicing one’s true opinion*
- *People do not normally criticise their own work*
- *Africans are communal people and appreciate co-creation rather than solutions being imposed on them.*

## Build

### *“Build the bridge as you walk on it ...” (Bob Quinn).*

The final is the building stage. In the ETILAB the ethos is to “build the bridge as you walk on it”. This does not require a full specification, architectural plans and detailed building plans before the actual work commences but rather building, talking to the client, obtaining feedback, modifying according to the feedback and being willing to destroy and rebuild when necessary.

This step requires building on the prototype in order to develop a fully functional solution.

The actual building and introduction into the market follow the acting stage. Nevertheless, even at this stage it is important to continue to be open to feedback and to modify the product is necessary.

Reflections on the build stage

- *Test and take the product to the market with the same openness to criticism and the willingness to modify.*
- *Build the bridge as you walk on it.*

### *3. Comments received from the participants in relation to the project artistry design principles:*

This section discusses the themes which emerged from the data collected from participants on the application of project artistry design principles in the ETILAB.

For each principle, the original text is recalled, and then its application in the context is discussed. The theme emerging from the participants’ comments and related to the design principle are then discussed. I then record my interpretation of the comments and their application to the design theme.

#### **1. Diverse teams**

## Design principle

*1. Ensure that the project artistry process is embarked upon with a diverse group of people.*

On entry to the project artistry model, the design thinking principle of ensuring that the project team is diverse is indicated in the principle below:

Radical collaboration: Bring together innovators from various backgrounds and with different viewpoints. Enable breakthrough insights and solutions to emerge from this diversity. Brown and Wyatt (2010) explained design thinking as a methodology in problem solving that assists interdisciplinary team members to create a “vibrant interaction environment that promotes iterative learning cycles driven by rapid conceptual prototyping” (Leifer & Steinert, 2011, p. 151).

## Application in the ETILAB

The groups were formed in such a way that there was diversity in terms of country of origin, race, discipline, gender and experience. This was predetermined as the educators were participating in a module that was intended to last for a week. They spent the afternoons attending the workshops that would result in their co-creating solutions for their context-specific problems.

## Feedback from the comments made:

The diversity of the ETILAB teams led them to take responsibility for their solutions as they wanted to reflect their context as “African” – see the comments below. There was also a fun sense of exploration as they thought about multiple options for naming the product using different languages to reflect their different contexts.

❖ *“I like the comment that we (are) coming from different contexts and we really need to come up with authentic mobile apps for our context so Africans should develop mobile*

*learning apps that are suitable for their contexts”.*

- ❖ *“We were searching for a name that encompasses what we wanted to do, so we were thinking in the African context of names, for example, “vula”, that means something. We looked at Zulu words, we looked at Afrikaans, we looked at English, we came across Swahili and we thought Swahili would be good – that’s how the name came about for the app”.*

It is evident in the comments above that the individual participants were willing to cross-racial and cultural boundaries in order to understand context from a multi-cultural perspective. This allowed the solution and its presentation to be relevant in a multi-cultural Africa and to be of use to a diverse audience.

#### Observation:

*\*Embracing diversity by facilitating an atmosphere that allows people to think “contextually relevant solutions” leads to an emergence of contextual literacy and new solution-centric ideas which, ultimately, results in context driven innovation.*

Suggested enhanced design principle: No modification.

#### Design principle

*1. Ensure that the project artistry process is embarked upon with a diverse group of people.*

#### 2. Problems are opportunities to apply CPS

#### Design principle

*2. Shift your perspective about a problem; see it as an opportunity to innovate*

There is a fundamental principle in the creative problem-solving school of seeing problems as a source of new products, markets and opportunities. Although this does not happen naturally, it is this way of seeing that will lead to new opportunities to solve those problems in creative, imaginative ways, hence the name “creative **problem** solving”. The experience of all the groups in the ETILAB sandpit was positive as regards seeing others’ problems as opportunities to innovate using mobile applications. However, as noted above in the discussion of the empathy stage, there were team that struggled to see the problems presented as opportunities to design relevant solutions. It was, thus, necessary to use facilitation to empower each team to know they were capable of uncovering a problem and seeing it as an opportunity. This could be done more deliberately.

Suggested enhanced design principle

**Enhanced design principle:**

2. Empower the team to embrace multiple perspectives, to listen to one another and to build creative confidence both as individuals and as teams

### 3. Ambiguity tolerance

**Design principle**

*3. Have a tolerance for ambiguity.*

Hagen & Park (2013) suggest that people who have tolerance for ambiguity and uncertainty portray leadership styles that promote innovative, adaptive, and entrepreneurial behaviours. This is crucial in creating a space for discovery, openness and creation.

### Application in the ETILAB



The participants were not informed about the workshop nor what the expectations were at the beginning of the process. In addition, they were not aware that, at the end of the week, they would have developed mobile applications for context-specific problems in education. Instead, they were guided each day through the ETILAB design process on the various stages until the solutions emerged.

During the interview, they were asked specifically about how they had felt on the first day when they found out be developing mobile apps. They responded as follows.

## Ambiguity

- ❖ *I went, like, 'What'! I was in shock because I imagined those kinds of things are done out there but not me.*
- ❖ *I didn't have any clue. In the end I knew how to do it and I'm confident now to go out and develop more apps.*
- ❖ *The idea of creating an app: Curious but very apprehensive.*
- ❖ *It was a daunting task and we could not imagine ourselves developing an app within 5 working days. Actually, by Monday there were 4 remaining days but we went in with a positive view and, with thinking design thinking, we launched ourselves into it.*
- ❖ *Not that at ease because I've never done anything like that, so I was a bit stressed.*
- ❖ *I was thinking 'Oh dear, programming, I'm not gonna make this, I was thinking more it was intense programme.*
- ❖ *When I started this week, I didn't even know what mobile learning was really but being able to go through all the activities then coming up with an app that can actually work on the computer., I really feel very, very blessed to be able to have these practical skills that I'm very eager to go out and try out.*
- ❖ *When you said that, by the end of the week we will be creating an app, I was thinking to myself 'Are they are out of their minds?' What's really going on because I don't know the secret behind these apps, it could be a lot, not even a week, it could take us even 3 months or so, even more, but just the few sessions that we had, I was like, everything was coming into light as if it was God*

*saying, 'Let there be light', and there was light, so that was exactly happening...*

❖ *With your help I felt more at ease.*

#### Observation:

The participants expressed all kinds of emotions including they had felt: apprehensive, shocked, daunted and stressed (see Appendix 8). However, it seemed that the facilitation had helped them to feel more at ease as the process unfolded.

#### Enhanced design principle

*3. Even if the team is apprehensive and negative feelings arise from the ambiguity, find ways in which to build their trust in you as a facilitator and lead them gently through the project artistry process.*

#### Project artistry design process – in this case the ETILAB process

#### Design principle

*4. Seek to uncover all the facts about a problem before moving into a solution space.*

#### 1. Project contextualisation

The entry point into the process is project contextualisation. This phase involves defining the problem, delving into the context, uncovering details that are not obvious about the problem and seeking to understand the underlying issues concerned. This phase draws on the design thinking principle of empathy. It also draws on the creative problem-solving principle of asking the right questions in order to clarify a problem and formulate a problem statement.

#### Design thinking principle: Empathy

*"In the realm of design, design-thinking is rooted in empathy, where you try to see from the perspective of a user of a given design or product. There is a lot more to design thinking than that but, in a nutshell, it is*

*about human centred design where empathy is king” (Ben Weinlick, 2013).*

*“Design theorists as well as practitioners describe empathy as a crucial impact factor of Design Thinking (e.g. Brown 2008; Kouprie & Visser 2009; Kolko 2011; Carlgren et al. 2013; GE Reports 2011)” (Meinel, 2015).*

### **Creative problem-solving principle: Questioning**

*“Creative problem solving is a process of asking advancing questions. It's a matter of asking the right questions at the right time to move the process forward. If you want to be more creative in your problem solving, learn the questions to ask and the proper sequence. When you ask questions -- listen without judgement” (CEF Resource Guide, 2015).*

*Ask problems as questions. Solutions are more readily invited and developed when challenges and problems are restated as open-ended questions with multiple possibilities. Such questions generate considerable rich information, while closed-ended questions tend to elicit either confirmation or denial while statements tend to generate a limited response or no response at all.*

### **Application in the ETILAB**

The ability to work closely with the users that the project crafter/facilitator ensures that they move from a problem situation to both a place of ownership of that problem and co-creation with the project teams in order to reach a creative solution together is essential. The users are taken on a journey of seeing a problem as a problem to being introspective about the problem, acquiring a different perspective on the problem and feeling empowered to co-create a solution with the project team. The comments of participants clearly indicated that in both the empirical situations, building empathy into the problem-solving situation had enabled an openness to user participation and input, This resulted in the solution providers walking a selfless journey with the users that had in turn capitalised on the users’ experience and input and ensured co-creation and empowerment on the part

of users as they were part of the problem solving.

The practitioner echoed this when he stated:

*# “Empathy allows the user to be introspective about the problem, to see it using a different lens and therefore become part of the solution creation” (Ng’ambi).*

The comment of the participants indicated stated below highlights the new understanding of empathy, the ability to forget one’s own experiences and subjective thoughts about certain subject matter but, rather, to focus on another person’s problem and seek to see the situation from that person’s perspective:

- ❖ *“I have learned to offer a gift of active listening and seeking to see the world from other people’s perspective”*
- ❖ *“When you want to solve a problem, be in the shoes of that person and that’s how you can solve the problem”.*

As indicated in the quote above, empathy or active listening is a prerequisite to seeing the problem from the client’s perspective. It enables contextual knowledge about the client’s world, an intuitive insight into the way in which the problem affects the client and what the solution would look like and feel to the client. It is from this point of intuitive intelligence that the co-creation of a holistic solution with the client may begin.

### **My observation**

- \* *The design process should start from both an intuitive knowledge of the client and from an understanding of how the problem is affecting the client, how the solution would “feel” like to the client. The design process then allows the “how the solution would feel like” to be translated into how the solution will “look” like. Inherent in the process of seeing the world from another’s perspective is the ability to empower the user to feel part of the problem-solving situation. This is*

*done to a point where the user does not feel that there is a divide between the problem-solving agents and the user him/herself because the project is conducted in such a way that the user is part of both the problem-solving process and the project team and is able to contribute everything he/she knows about the project.*

### **Enhanced design principle**

*4. Seek to uncover all the facts about the problem before moving into a solution space. Be aware that there is a natural tendency to move into a solution mode before deeply engaging with the problem. Thus, the team members may help each other to remain within the project clarification phase and to be patient during this phase.*

## **2. Project ideation**

### **Design principle**

*5. Know when to defer judgement as a team and when to make decision and take a stance.*

This stage involves coming up with as many solutions to the problem as possible before deciding on a solution. In other words, it involves devising numerous options using imagination and brainstorming before converging into one solution. Thus, it draws on the creative problem-solving principle below:



### **Creative problem solving: Deferred judgement**

*According to the principle of deferred judgement, while exploring the possible solutions to a problem, firstly you diverge with your thinking and then you converge. Thus, there are two separate stages. However, it is possible to do only one at a time. To diverge means to ask "Why?" and "What if?" After you have finished diverging then you converge. To converge means to you ask "How?" and "What is needed?" Zoom out then zoom in (CEF Resource Guide, 2015).*

### **Application in the ETILAB:**

The principle of deferring judgement as a team was made easier with a demonstration exercise of “What is half of 8?” Although the known mathematical answer to this question is 4 the participants were encouraged to use the principle of deferred judgement to explore more right answers and building on each other’s ideas to allow the emergence on novel answers to a common problem.

\*\*\* One of the participants in one workshop suggesting building on the notion of half of 8 being w and

stated It is spectacles  while another suggested that it was a compass  and so the list continued.

The important point in this demonstration was that, during the converging process, when it is time to take a stance and make decisions that will move the group forward after exploring a phenomenon in such a wild and open way, the group now has numerous option from which to choose and they may use a number of converging processes to converge into one or a few ideas with which they then move forward. For example, the group may have chosen to use the compass that had been suggested. This implies acceptance of the specific phenomenon, and being open-minded as well as willing to accept possibilities regarding whatever has emerged from the exploration as group. This acceptance and openness to emerging possibilities are core to project artistry as a group explores and seeks novelty, thus ending up in a space in which nobody, including the facilitator and the participants, expected to find themselves.

- ❖ *“The eduTracker was developed to help the students who are actually struggling.”*
- ❖ *“Now, I actually feel that the sky is not the limit because if we can do this in couple of days with the client... what could do with more time?! I’m looking forward to designing an application.”*
- ❖ *“I’ve enjoyed this module in such a way that it has changed my way of thinking and I see myself as a problem-solver out there.”*
- ❖ *“We wanted to respond to the teacher’s professional development which we saw as more a formal activity ...”*

## Observation

*The participants must become engaged in exercises that challenge their ways of being, thinking and seeing. Challenging the common things that they hold to be true (as in the half of 8 exercise) should result in a leap into the uncommon (as in a compass being the half of 8). This will create a breeding ground for the emergence of novel ideas and radical innovations to take place*

## Enhanced design principle

*5. Be deliberate in building in exercises that encourage play and fun and with the emphasis not on judging but on learning from mistakes.*

## 3. Project prototype

### Design principle

*6. Seek to make a physical artefact that comes as close to the real experience as possible.*

During this stage, the project team takes a stance, makes decision and makes an artefact quickly to test, refine, learn from the experience and develop project concepts based on tangible tests.

### Design thinking principle: Experimentation

*"Rapid Prototyping expressing a new concept in a tangible form for exploration, testing, and refinement" (Liedtka, 2014).*

*"Prototyping and experimentation produced conversations with real customers, a better source of information than PowerPoint presentations to colleagues in conference rooms. And all of this market-based learning generated forward momentum and energy for the project" (Liedtka, 2014).*

## Application in the ETILAB

The project teams were equipped with the basic technical skills required to develop mobile applications and then immediately tasked with developing the basic interface for the mobile application together with icons in order to provide their client with a physical artefact with which to interact.

## Comments from the participants

- ❖ *“It was a process actually because I think we came up with a ‘really Cool app’ and then a cool app’ and then, during one of the evenings I suddenly thought “Oh, the cool group wanted a ‘Scool app’ so the “Scool app” evolved”.*
- ❖ *“We were searching for a name that encompassed what we wanted to do so we were thinking in the African context of names, for example, like ‘vula’ that means ‘something’, and we looked at Zulu words, we looked at Afrikaans, we looked at English, then we came across Swahili and we thought Swahili would be good. That’s how the name came about for the app.”*

## Observation

*As soon as participants had developed the mobile applications online, they became infused with new energy that made the mobile application come alive for them, they became excited and it seemed their minds were again unlocked and they wanted to play and do more. However, they were guided to remain with the context and the problems they were solving.*

## Enhanced design principle

*6. Seek to make a physical artefact that is as close to the real experience as possible. This requires learning and creativity with regard to how best to present the artefact, in this case, learning a technology.*



#### 4. Project conceptualisation

##### Design principle

*7. Develop project concepts from the prototype, empowered by user feedback and comments*

Finally, after receiving feedback on the prototype developed in the previous phase, a project concept may now be built based on both the co-creation process and the feedback from the experiment.

##### Design thinking principle: Co-creating

*“Seeking that sweet spot of feasibility, viability, and desirability as you take into account the real needs and desires of your customers is part of what we at IDEO and the d.school call “design thinking.” It’s our process for creativity and innovation” (Kelly & Kelly, 2013).*

##### Application in the ETILAB

A presentation room was set up in a professional manner to allow the “supplier group” to demonstrate to the “client” group. The presentation was followed by a dialogue that facilitated feedback about the prototype and comments about further development of the prototype.

##### Comments from the participants

- ❖ *“It was a process actually because I think we came up with a ‘really Cool app’ and then a ‘cool app’ and then, during one of the evenings I suddenly I thought ‘Oh, the cool group wanted a ‘Scool app’ and so the ‘Scool app’ evolved.”*
- ❖ *“We were searching for a name that would encompass what we wanted to do, so we were*

*thinking in the African context of names, for example, like 'vula' that means 'something', and we looked at Zulu words, we looked at Afrikaans, we looked at English, we came across Swahili and we thought Swahili would be good. That's how the name for the app came about".*

### Comments from the practitioner

- *Allow users to touch and feel*
- *Give them power to comment early in the process*
- *HONESTY and TRUST*
- *Do not underestimate the intelligence of the user*
- *Assume they are rational and may be critical*
- *In the African context 'if people feel marginalised, they may not tell you but simply not use your product'*
- *The element of co-creation inherent in design thinking takes away the fear of voicing one's true opinion*
- *People would not normally criticise their own work*
- *Africans are communal people and appreciate co-creation rather than solutions being imposed on them.)*

### Observation

- \* *During the first presentation, I took it for granted that the dialogues would be positive, appreciative and empowering. However, the very first comment made by the clients was negative and created a bad "vibe" in the discussion with the suppliers becoming defensive and the clients becoming demanding and critical of the solution. Thus, I realised at that point that this principle would to be adjusted to indicate that, in the project artistry framework, the guidance must facilitate a positive, encouraging and appreciative attitude that then results in both co-creation and ownership by each party as regards the prototype. This was emphasised in the following presentations. The environment changed and was more conducive to the sharing of ideas and*

*thoughts with clients appreciating the time and effort that suppliers had expended in developing solutions for them.*

### **Enhanced design principle**

*7. Gather feedback from those for whom you are creating in a positive environment. Ensure a positive feedback tool or environment that promotes feedback that builds, develops and expands on the idea.*

#### **3.1.1 Underlying principles of the whole process:**

### **Design principle**

*8. Diverge to seek multiple realities, and then converge into fewer options that move you forward.*

The following four pillars support the entire project artistry process and apply in every phase of the process.

### **1. Diverging and converging**

*“Keys to creativity are learning ways to identify and balance expanding and contracting thinking (done separately) and knowing when to practice them. Defer or suspend judgement” (CEF Resource Guide, 2015). As Osborn learnt in his early work on brainstorming, an instantaneous judgement in response to an idea shuts down the generation of ideas. The appropriate and necessary time to apply judgement is during the converging.*

### **Application in the ETILAB**

The project teams were equipped with the basic technical skills required to develop mobile applications. They were then immediately tasked with developing the basic interface for the mobile application together with icons to give their client a physical artefact with which to interact.

### **Comments from the participants**

- ❖ *“It was a process actually because I think we came up with a ‘real cool app’ and then, one evening I suddenly thought ‘Oh, the cool group wanted a ‘Scool app’ and, so, the ‘Scool app’ evolved.”*
- ❖ *“We were searching for a name that encompassed what we wanted to do so we were thinking in the African context of names, for example, like ‘vula’, that means something, and we looked at Zulu words, we looked at Afrikaans, we looked at English, we came across Swahili and we thought Swahili would be good. That is how the name for the app came about.”*

## Observation

- \* *As soon as the participants had developed these mobile applications online, they became infused with new energy that made it come alive for them; they became excited and it seemed their minds had been unlocked again and they wanted to play and do more. However, they were guided to stick with the context and the problems they are solving.*

## Enhanced design principle

*8. Be deliberate about building short, fun activities in constantly remind participants that they are, after all, in the sandpit.*

## 2. Applied imagination

### Design principle

*9. Use imagination in every step of the process deliberately.*

*Osborn studied creative people to identify the natural process of how they naturally create good ideas. With the goal of approaching problems with greater imagination, he incorporated his learnings into the first versions of the CPS process, helping people learn how to be more deliberately creative.*

(CEF Resource Guide, 2015)

## Application in the ETILAB

The participants were urged to come up with as many solutions as possible, to tap into their imaginations and to allow their minds to go beyond the existing situation.

## Comments from the participants

- ❖ *"The design thinking process: it opened my mind..."*
- ❖ *"It liberated my mind"*
- ❖ *"This course has really inspired me to tap into my creative side which I really didn't think that I had and I think it was an amazing way to get me to find solutions and to be creative about solutions I found to the challenges that I had identified. Normally, when I had to look to finding solutions this used to be a very boring kind of plotting, long way without looking".*

## Observation

- \* *The participants allowed themselves to imagine possibilities, to free their minds and to think "What if?". The comments quoted above demonstrated this. However, despite the time constraints, I still felt that the participants could have pushed the boundaries of their thinking further although time would have been required introduce the tools, exercises and activities that would have launch them deeper into imagination.*

## Enhanced design principle

9. Build in activities that will result in the participants tapping into their imaginative side. Create an atmosphere of play by removing inhibitions and allowing fun and laughter.

4. **Creative language:** Focus on "Yes, and ..." rather than "No, but".

## Design principle

*10. Ensure that creative language is used to constantly inspire more ideas.*

*Language matters in the generation of information and ideas. “Yes, and” allows for the continuation and expansion that is necessary in certain stages of CPS. On the other hand, the use of the word “but”, whether preceded by “yes” or “no”, closes down conversation, negating everything that has come before it.*

### **Application in the ETILAB**

Creativity has its own language. It has been found that people are inclined to judge ideas and smother them before they are developed. The language of creativity is not everyday language and, hence, it was necessary to put in place rules and language suited to creativity in order to integrate these rules and language into the experience.

### **Comments from the participants**

*There were no specific comments made that were linked directly to the issue of language. I believe there was not sufficient emphasis on this principle in the course.*

### **Observation**

*Although there were no comments that referred specifically to this principle, I believe that the principle of diverging and not killing ideas but, instead, building on other people’s ideas did emerge. Thus, in the future reference< I think it is vital that this point is made much more explicit for it to impact on the culture.*

### **Enhanced design principle**

*10. Socialise the team into using the language of creativity when communicating*

## **5. Reflection**

### **Design principle**

*11. Incorporate reflective practice throughout the process to encourage learning from the process.*

*Design thinking is a reflective practice. The trial and error techniques in the design process share a similar approach to that of the reflective practice proposed by leading social scientist Donald A. Schön (1983) in that the design process revolves around situations rather than problems.*

### **Application in the ETILAB**

The participants were asked to reflect each morning on their experience of the previous day. Some of these reflections were recorded and informed this study.

### **Comments from the participants**

*From Appendix 9, the red text in the feedback from the participants denotes the transcription of the audio recording of the reflections of the participants.*

### **Outlook**

*“We do not learn from experience, we learn from reflecting on that experience” (John Dewey).*

Building moments of reflection into project artistry enables the participants to learn and embody the principles of project artistry and, thus, allow them to impact on their outlook to life.

One participant stated:

❖ *“The design thinking process: it opened my mind, it liberated my mind. It has changed my whole outlook”.*

### **Enhanced design principle**

*11. Let the participants reflect on every stage of the process in order for the learning to become deeply embedded.*

#### 4. Development of the design principles emerging from the comments and categories discussed above.

Table 12: Summary of the modification of the design principles emerging from the first iteration

Project artistry design principles tested in this thesis	Enhanced project artistry design principles	The ABC of Design Thinking modification
1. Ensure diversity of the project team.	1. Ensure the diversity of the project team. In addition, create an atmosphere that allows the teams to tap into this power of diversity through the belief that the contributions of all are heard and valued.	D: Diversity G: Genius X: Xenodochial
2. Shift your perspective about a problem and see it as an opportunity to innovate.	Empower the team to embrace multiple perspectives, to listen to one another and to develop creative confidence both as individuals and as teams	N: New perspectives C: Creativity and co-creation
3. Allow yourself to start from a place of ambiguity	Even if the team is apprehensive and negative feelings arise from the ambiguity, find ways in which to build their trust in you as a facilitator and lead them gently through the uncovering of the deeper issues related to the problem.	A: Ambiguity tolerance M: Meaning S: Story
4. Seek to uncover all the facts about a problem before moving into a solution space.	Seek to uncover <b>all</b> the facts about the problem before moving into a solution space. Be aware that there is a natural tendency to get into a solution mode before deeply engaging with the problem and, thus, the, team members could help each other to remain within the project clarification phase and be patient during	K: Knowledge



	this phase.	
5. Encourage the deferral of judgement	5. Encourage the deferral of judgement and be deliberate about it through designing activities that ensure this.	J: Judgement on and off
6. Seek to make a physical artefact that is as close to the real experience as possible.	Seek to make a physical artefact that is as close to the real experience as possible. This requires learning and creativity as regards how best to present the artefact. In this case <i>learning a technology</i> .	R: Rapid prototyping
7. Develop project concepts from the prototype, empowered by user feedback and comments.	Gather feedback in a positive environment from those for whom you are creating. Ensure that there is a positive feedback tool or environment available that allows feedback that builds, develops and expands upon the idea.	X: Xenodochial V: Visualisation
8. Engage an element of fun and play in order to generate curiosity	Be deliberate about building in short, fun activities to constantly remind participants that they are, after all, in the sandpit after all	P: Play H: Human-centred
9. Use imagination in every step of the process deliberately.	Build in activities that will result in the participants tapping into their imaginative side. Create an atmosphere of play by removing inhibitions and allowing fun and laughter. In addition, encourage futuristic approaches.	B: Brainstorming and Imagination F: Futuristic O: Originality Q: Quality "What if?" "Yes and..."
10. Ensure that creative language is used to constantly to inspire more ideas.	Socialise the team into using the language of creativity when communicating.	L: Language

11. Incorporate reflective practice throughout the process to encourage learning from the process.	Allow the participants to reflect on every stage of the process to ensure that learning is deeply embedded.	U: Unlearning T: Translucence

This concludes the first iteration in the educational sandpit. The video material, survey results, transcribed materials and project artefacts emerging from this work are available on request from the researcher.

### 5.3.2 Application in the multidisciplinary sandpit

#### 5.3.2.1 Overview of the second iteration in the multidisciplinary sandpit

The next iteration took place in the multidisciplinary sandpit where a group of young academics from across the African continent had been invited to participate in week long fellowship programme in order to co-create multidisciplinary research projects that addressed the problems of leadership in academia in the continent. This is called the Africa Science Leadership Programme (ASLP). The project artistry framework was used to guide the process, although it was also, to a significant extent, informed by the enhanced design principles that had emerged from the first iteration as discussed above.

The setting was a natural setting in that the participants were not informed about either the process or the assignment in advance. Instead, they were guided through the design process every day with every stage being enacted on a daily basis daily throughout the six days. While this was happening, the researcher was journaling and reflecting with the practitioner who was observing the process. Both the researcher and the practitioner were involved both in a process of reflection and in redesigning the setting and leadership as various aspects emerged. This section explains the journey undertaken in this iteration, the outcome and the learning that feedback to the project artistry design principles.

#### 5.3.2.2 ASLP Participants

Appendix 11 presents the disciplines, institutions and gender of the participants as well as the countries from which they came.

#### 5.3.2.3 Projects that emerged from the ASLP iteration

Throughout the week, the fellows worked on identifying the key challenges to science in Africa and on developing projects that could affect that reality. Subsequent to the study, these projects were being developed further with the support of the ASLP management team. The projects, a brief description of each project and the list of participants are presented in Appendix 12.

#### 5.3.2.4 Project artistry in this context

The groups of young researchers from eleven different African countries and with diverse skills and from various disciplines were selected as fellows in the African Science Leadership Programme (ASLP). They spent a week in a full-time programme that facilitated the generation of multidisciplinary projects that would address the challenges facing leadership in academia in Africa. During this phase of the research study, I worked with leading experts in the field of innovation while the project artistry design principles that had emerged from the previous iteration in the educational technology sandpit were used to inform this sandpit process. The next sections discuss the outcomes of the projects, the design principles that informed the process, and the feedback from the delegates on their experiences during the week. The emerging themes were used to enhance the process further.

In order to reinforce the principles a number of tools were selected in order to reinforce these principles.

#### 1. Entry into the process:

The participants who gathered together had not known each other prior to the meeting. They had come together with a specific purpose: a gap had been identified in the African academia, namely, there was a lack of leadership acumen and the faculty was chosen to develop and address this gap.

As reflected in Table 6 above, a diverse team had been selected in terms of disciplines, gender and countries of origin as the aim was to conceive multidisciplinary leadership projects in the context of the African continent.

#### 2. The process

The design process followed was closely aligned to the design process depicted in Figure 4 above with each phase dedicated to a day while the final day was devoted to project presentations and the

development of projects teams.

### 3. Exit of the process

The result of the process was a set of multidisciplinary leadership projects with well-defined project concepts and project teams that were engaged and excited about implementing these projects. These are defined in the next sections.

### 4. Design pillars

The design principles which emerged from iteration 1 were applied in the second iteration using tools to reinforce the learning from the previous iteration.

*Table 13: Design principles and applied tools in the multidisciplinary sandpit*

Enhanced project artistry design principles	Tools/practices used to guide the process
1. Ensure the diversity of the project team. Beware of socio-cultural issues that may hinder the participation of team members and ensure everyone is given an equal opportunity to contribute through activities that create an environment of thinking equals.	Table 10 above illustrates the diversity of the team chosen in terms of discipline, country of origin and gender.
2. Empower the team to embrace multiple perspectives, to listen to one another and the confidence to create, both as individuals and as teams	Generous listening (3-way/4-way) Clustering in silence
3. Even if the team is apprehensive and experiencing the negative feelings arise from the ambiguity, find ways to in which to instil their trust in you as a facilitator. Lead them gently through the uncovering of deeper issues related to the problem.	Picasso in a bag

4. Seek to uncover <b>all</b> the facts about the problem before moving into a solution space. Be aware that there is a natural tendency to move into a solution mode before deeply engaging with the problem. Team members may help each other to stay within the project clarification phase and to be patient during this phase.	Mind-mapping Political, Economic, Social, Technological, Legal Environmental (PESTLE) tool
5. Be deliberate in building in exercises that encourage play and fun and which emphasise judging but learning from the mistakes made.	Artistic experiences were built into the programme to encourage laughter, fun and enjoyment.
6. Seek to make a physical artefact that is as close to the real experience as possible. This requires learning and creativity as regards how best to present the artefact (in this case, <i>learning a technology</i> ).	Future headlines
7. Collect feedback from those for whom you are creating in a positive environment. Ensure that there is a positive feedback tool or environment that enables feedback that build, develops and puts expands on the idea.	Potential pluses, concerns and overcome concerns (PPCO) tool
8. Build in an element of fun, play, and anticipation that will lead to productive play.	Painting exercise and other short, fun exercises were used
9. Build in activities that will result in the participants tapping into their imaginative side. Create an atmosphere of play by removing inhibitions and allowing fun and laughter.	Future headlines Sticky steps
10. Learn the language of creativity. Socialise the team into the language of creativity	Framing a problem into a challenge
11. Allow the participants to reflect on every stage of the process to ensure that the learning is deeply embedded	Reflection exercises were conducted at the end of each day

### 5.3.2.5 Discussion of the tools listed above and their application in the educational sandpit

## Entry into the process:

### 1. Picasso in a bag

#### Application:

The participants started the workshop with a fun-filled evening during which they engaged in the activity of drawing each other's faces without lifting the pen from the paper and also without looking at the drawing. Most drawings resembled those presented in Figure 48 below. The picture drawn was used as the profile picture of the participant in question for the entire week.

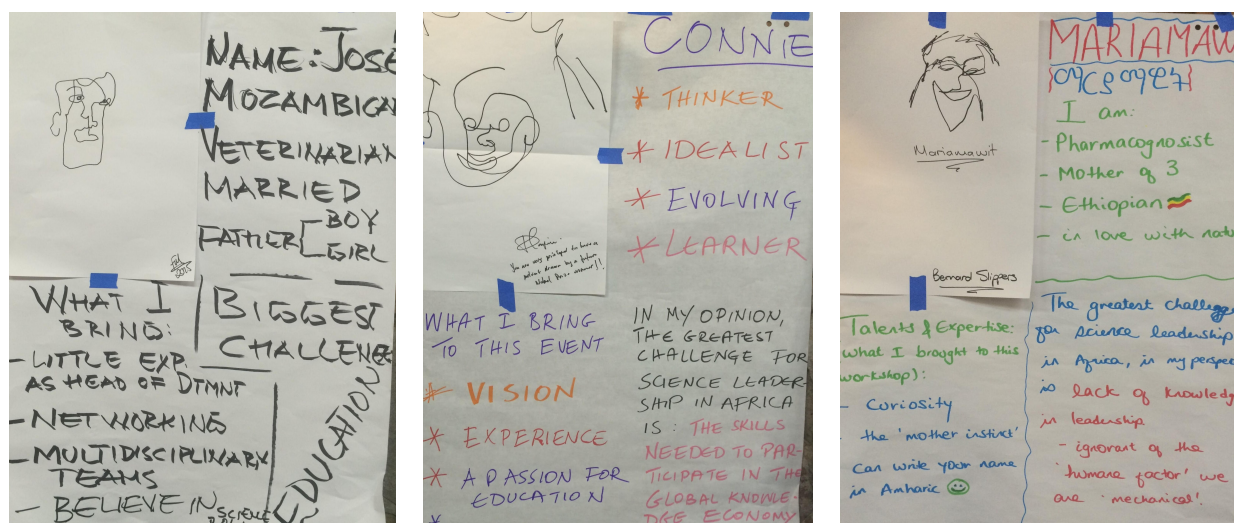


Figure 34: Sample participant profiles from the sandpit workshop

#### Benefits:

This exercise formed part of the exercise of "levelling the playing field". An awareness of the socio-cultural issues that have may impacted on their participation as well as their openness to both the process and to one another led to the choice to use a fun activity that would result in laughter and in everyone feeling relaxed and comfortable. It would also detach them from their

status and/or the need to impress the other participants with their qualifications, discipline, achievements and other factors and, instead allow them to relax into the space where the profile pictures resembled those presented above and first names were used instead of titles.

This not only “levelled the playing field” for the coming interactions and participation but it also represented an attempt to try to make the participants feel comfortable with the ambiguity and uncertainty of the programme ahead.

## 2. Generous listening

### Application

A communication session forcing each member to adopt the role of talker, listener or scribe who observes and takes notes:

- Talker uninterrupted for 5 minutes.
- Listener takes the time to listen attentively, without interrupting
- Scribe observes and takes notes

### Benefits:

- Develop active/appreciative listening skills.
- Helps to suspend judgement.
- Gives airtime to the speaker to enable the speaker to communicate his/her worldview without interruptions.
- Allows the views of another to be captured.

## Project contextualisation phase

## 3. Framing a problem into a challenge



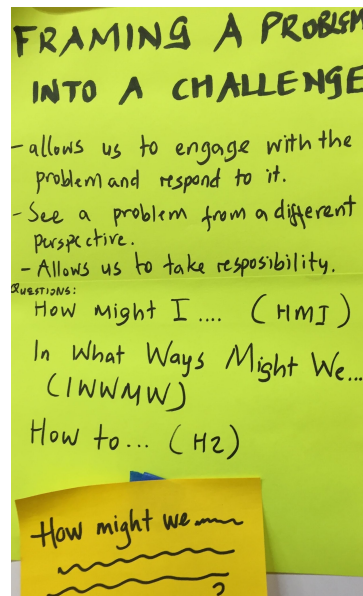


Figure 35: Framing a problem into a description of a challenge

### Application:

Converting the statement of a challenge into a question that creates a platform for potential solutions

### Questions start with

- How might I (HMI)?
- In what ways may we (IWWMW)?
- How to (H2)?



Figure 36: Participants framing the problems into opportunities using creativity language

### Benefits:

- Allows participants to engage with a problem and respond to it.
- Allows participants to see a problem from a different perspective.
- Gives them the opportunity to take responsibility – act on it

#### 4. Clustering in silence

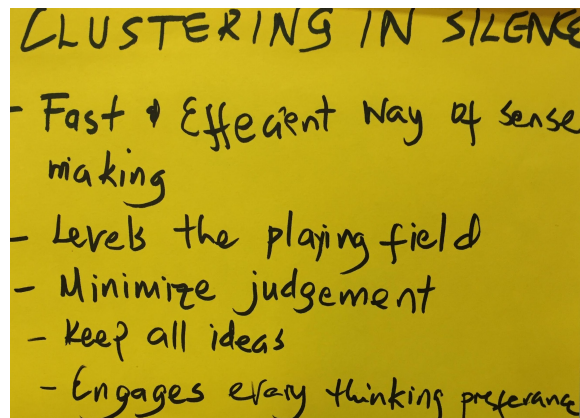


Figure 37: Description of clustering in silence

#### Application

The grouping of challenges and labelling of groups in silence.

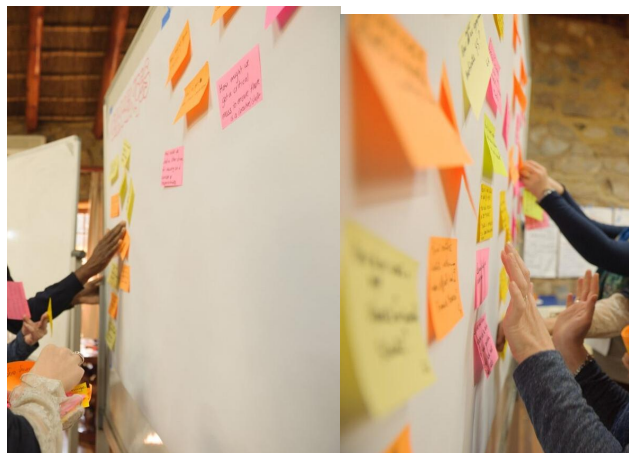


Figure 38: Participants clustering in silence

#### Benefits

- Fast and efficient way of sense making

- “Levels the playing field”
- Minimises judgement
- All ideas retained
- Engages all thinking preferences

## 5. Mind-mapping

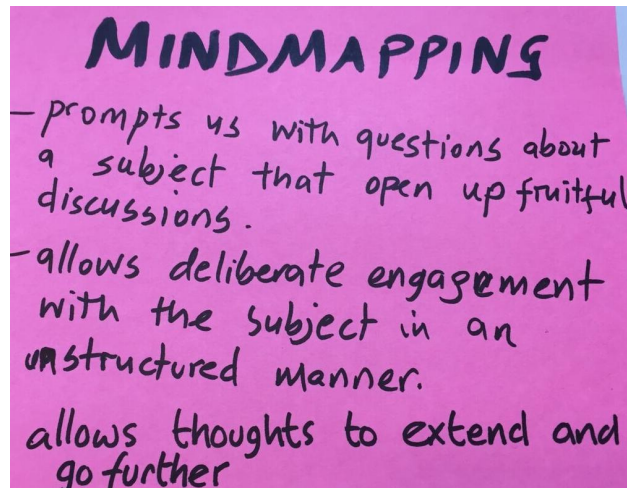


Figure 39: Mind mapping definition

### Application:

The jotting down of all the aspects of a concept. The participants were asked to create mind maps of their projects to fully explore all the aspects of the project and not just emerging themes and links.

### Benefits:

- Prompts participants with questions about a subject and that open up fruitful discussions.
- Allows deliberate engagement with the subject in an unstructured manner.
- Allows thoughts to extend and go further than may otherwise have been the case.

## 6. Political, Economic, Social, Technological, Legal Environment (PESTLE)

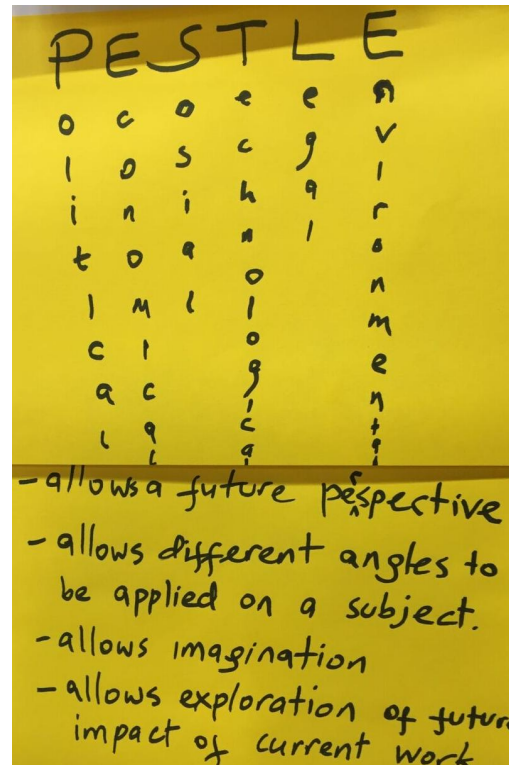


Figure 40: Definition of PESTLE from the tool board

### Application:

The six aspects that affect and are affected by work, both at the time and in the future

P- Politics

E-Economics

S-Social

T- Technology

L-Legal

E-Environmental

The participants were asked to brainstorm the above within their groups and then, collectively, on the wall, as depicted in the figure below consider all the challenges identified in 2015, 2020, 2025, and 2030. They then pasted their group feedback on the wall to create a holistic view which incorporated inputs from everyone.



Figure 41: PESTLE wall at the workshop

### Benefits:

- Allows a future perspective
- Allows various angles to be applied on a subject
- Fosters imagination
- Allows the exploration of the future impact of current work

## Project ideation phase:

### 7. Painting exercise

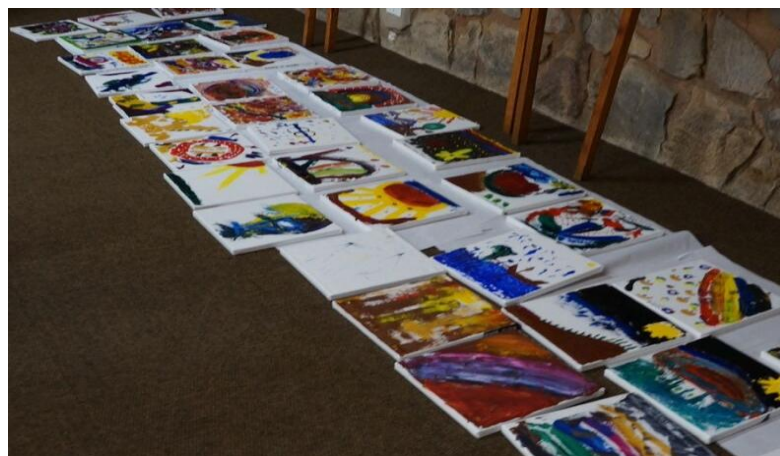


Figure 42: Paintings from the exercise



### Application

The participants took part in a painting exercise during which they were each given a canvas to play with paints and to spend time painting on their canvases. Within a certain time frame, they were instructed to rotate and to paint on each other's canvases. There were four rotations before each participant returned to his/her original canvas, which at this stage looked very different after having been painted by four other people.



Figure 43: Painting exercise in the workshop

### Benefits:

This exercise propelled the participants into a thinking space that encouraged openness and the embracing of the unique talents and contributions of other people. The ideation design principle 5 emphasises the need for the deferring of judgement and openness to multiple perspectives. The use of art to reinforce this principle in the exercise encouraged the participants both to self-reflect and to develop their own learning as regards letting go and embracing the contributions of others.

### Project prototype phase:

#### 8. Future headlines

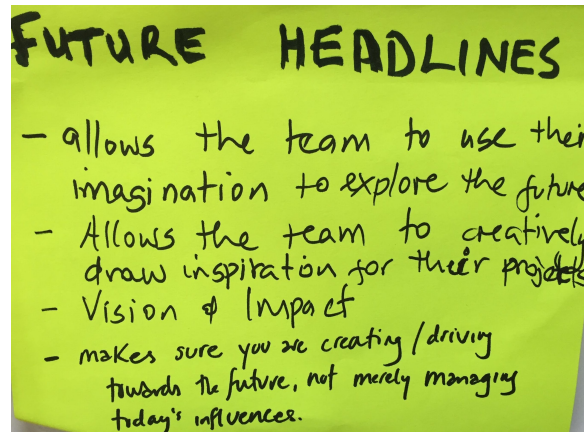
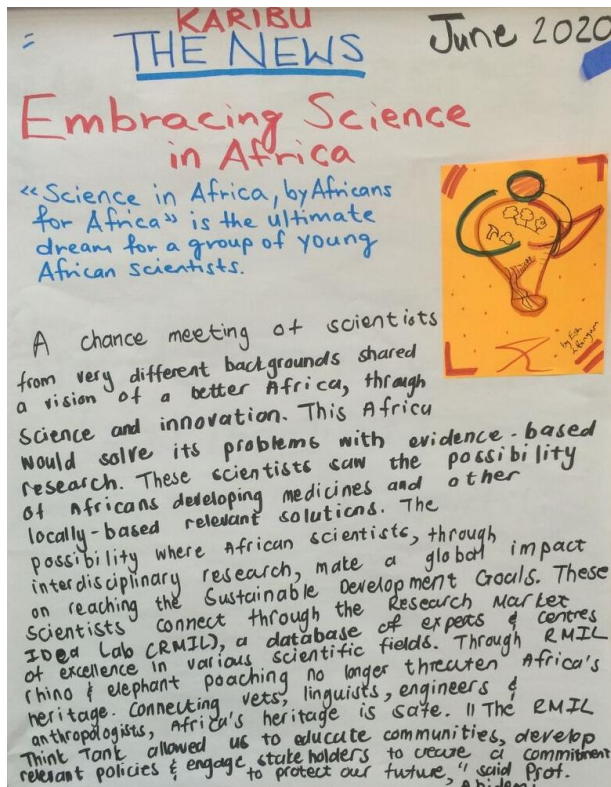


Figure 44: Description of future headlines

### Application:

Based on the ideas which had emerged from the project ideation phase, the participants had to take up a position and choose project ideas that resonated with them. They then had to work in groups in order to build on these ideas. Each project team had to develop a quick, visual draft of a future news headline describing the impact of the project ten years hence. They had to do this creatively and then make live presentations with visually appealing graphics to capture the audience's imagination and transport them to this place. The images below are examples of future headlines from the projects conceived in the sandpit.

Figure 45: Sample future headlines from the workshop



### Benefits:

- Allows them to make the project as real as possible for the audience
- Allows the team to use their imaginations to explore the future
- Allows the team to creatively draw inspiration for their projects
- Vision and impact
- Ensures that, as they develop concepts, they are creating/driving towards the future and not merely managing current influences.

## Project conceptualisation phase

### 9. Pluses, Potentials Concerns and Overcome concerns (PPCO)



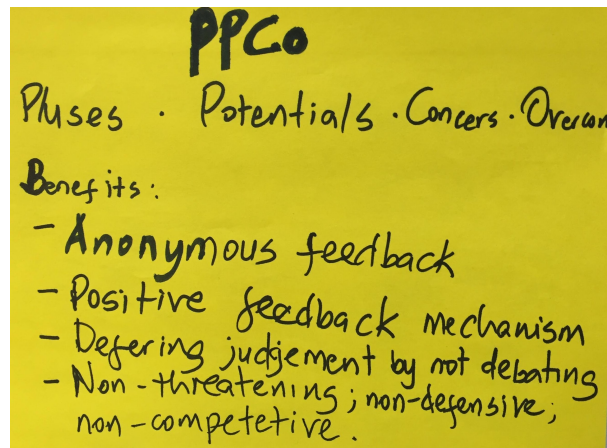


Figure 46: Description of the PPCO on the tools wall

### Application:

This applies during the project conceptualisation, after presentation of the project ideas. The audience is requested to provide feedback in the form of a tool that reinforces a positive, appreciative environment as per design principle 7 and using the themes **pluses; potentials; concerns; overcome concerns**.

The audience is expected to contribute to each theme after the presentation. The presenters then use this feedback to develop their project proposals into both project concepts with clear objectives as well as the means to achieve these projects.

Each group was given an opportunity to present their project concept to the whole class. The feedback mechanism used was the PPCO tool in order to encourage a positive feedback environment and also to enable comments from all the participants to be captured within a short space of time. A feedback wall with titles was put up on the walls so that the participants could paste their comments slips under the relevant titles. An example of the feedback from one of the participants is presented in the image below.

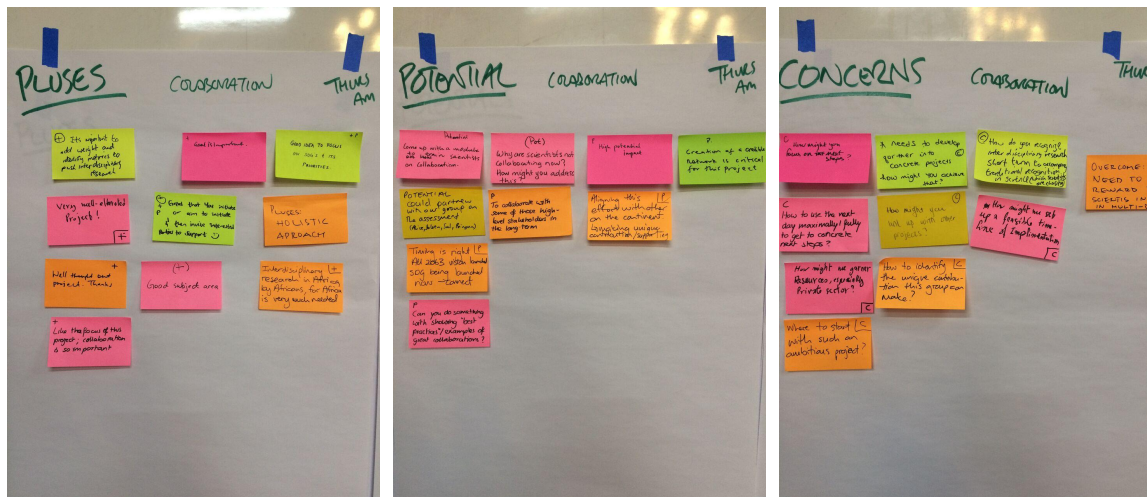


Figure 47: Feedback process using the PPCO

## Benefits

- Anonymous feedback
- Positive feedback mechanism
- Deferring of judgement by no debating
- Non-threatening, non-defensive, non-competitive
- Affords the collection of feedback from a number of people within a short space of time.

### 5.3.2.6 Participants' feedback analysis

All the participants were interviewed at the end of the week. Open-ended questions were asked about their experience, the process and their feedback on their overall programme.

The interviews were then transcribed and, using coding and thematic analysis, they were categorised and reported according to the emerging themes below together with the researcher's comment and observations at the end of each theme.

The themes which emerged from the data collection after the workshop are summarised in Appendix 16. The feedback from the participants, the reflective notes and the video clips from the workshops

were carefully analysed to review the design principles that had initially been proposed in the study and then enhanced by means of the first iteration. Below is a summary of the modified design principles based on the second testing in the multidisciplinary sandpit. The discussion in Chapter 6 elaborates on the categorisation and emerging themes that informed the design principles.

### 5.3.2.7 Enhanced design principles that emerged from the multidisciplinary sandpit

Table 14: Enhanced project artistry design principles

Enhanced project artistry design principles from the first iteration	Practice in the multidisciplinary sandpit	Enhanced project artistry design principles from the second iteration
1. Ensure the diversity of the project team. Also, beware of the socio-cultural issues that may hinder the participation of team members. “Level the playing field” through activities that create an environment of thinking equals.	Despite the diversity of the team (as illustrated in Table 11), the enhanced principle stipulates that facilitator must be aware of socio-cultural issues that may hinder the co-creation process. This awareness may come about deliberately through a prior survey/questionnaire aimed at gathering useful information about the participants.	Ensure the diversity of the team within the context of the projects being developed. Then use either surveys or questionnaires to acquire information about the participants that will help in understanding their mentality and personality types prior to engagement and programme development.
2. Empower the team to embrace multiple perspectives, to listen to one another and to have confidence in their creativity as both individuals and as	Although the participants were extremely accomplished in the field of education, it was extremely important that this assumption did not be	Spend sufficient time thinking about the exercises and activities that will empower the participants and increase their creative confidence and then to embrace each other’s creativity and

teams	regarded as equating to empowerment in terms of brainstorming. It was, thus, essential that deliberate activities to empower the participants to listen to others, embrace multiple perspectives and have confidence in their creativity were embedded in the programme.	perspectives. This may require the practical use of artistic activities.
3. Even if the team is apprehensive and negative feelings arise from the ambiguity, find ways in which to gain their trust you as a facilitator and lead them gently through the uncovering of deeper issues related to the problem.	The participants admitted to their discomfort with the ambiguity of the programme. Consequently, a high-level overview of the programme was issued to allay this discomfort.	Identify high priority issues and develop exercises that attempt to combat the effects of some of any socio-cultural issues in order to create a healthy thinking space and help the participants to relax into the space. Once there is an awareness of any possible socio-cultural issues (data collected in accordance with principle 1. In certain contexts, it may be necessary to provide a high-level overview of the programme, to help the participant to relax and in other instances, to create a sense of excitement about what may emerge from the ambiguity.
4. Seek to uncover <b>all</b> the facts about the problem	It is a natural tendency for adults is to move into the	Use the language of creativity to help the participants to remain in

before moving into a solution space. Be aware that there is a natural tendency to move into a solution mode before engaging deeply with the problem. Team members may help each other to remain within the project clarification phase and to be patient during this phase.	solution space prematurely. However, this is discouraged in project artistry. The creativity language helped to ensure that the participants remained in the inquisitive mode.	the “questioning” mode rather than the solution mode. It is perhaps important, from the beginning of the programme, to socialise the group in the language of creativity and to keep using the (How might we, In what ways might we, How to) questions during the contextualisation phase.
5. Be deliberate in building in exercises that encourage play and fun and also emphasise not judge but learning from mistakes made.	Painting exercises, Picasso in a bag, and other activities that were built into the programme facilitated an atmosphere of fun and engagement while reflecting on the activities empowered the members to learn the importance of judgement.	Ensure that there is time for reflection, individually and/or in groups to ensure learning from those activities about judgement. In as much as exercises that encourage fun, laughter, and play are built into the programme.
6. Seek to make a physical artefact that is as close to real experience as possible. This requires learning and creativity as regards how best to present the artefact.	The use of future headlines did not only enable a future perspective but also helped to make the projects real.	Understand the context, push the boundaries and allow the participants to go to extremes to ensure as real an experience as possible of the artefact.
7. Gather feedback from those for whom you are creating in a positive environment. Ensure that there is a positive feedback	A positive feedback environment must be facilitated through language, creativity tools and an atmosphere which fosters	Use tools such as the Pluses, Potential, Concerns and Overcome Concerns (PPCO) tools to reinforce a positive atmosphere for feedback. Do not assume that,

tool or environment that facilitates feedback that builds, develops and expands on the idea.	positive contributions during the presentations. This impacts positively both on those presenting ideas and on those contributing to build the idea.	because there is positive energy in the room and excitement, the feedback will also be positive.
8. Educate the participants in the principles of converging and diverging and, if possible, display the rules up on the wall.	Actions spoke louder than words in this iteration. Although the participants were briefed on the principles involved in the science behind the experience, the activities that socialised into the practice appeared to be more effective as compared to the briefing.	Integrate time-bound exercises, activities, tools that allow thoughtful converging and diverging during the different stages. It may not be necessary to socialise the participants into the jargon if it is inherent within a programme.
9. Build in activities that will result in the participants tapping into their imaginations.	Tools such as the future steps allowed the participants to use their imaginations to conceptualise their projects in the next ten years. This made the projects more real and exciting.	Find the balance between being analytical and intuitive and exploiting and exploring to ensure that the participant remain imaginative but also seriously realistic. Do not under estimate the power of imagination.
10. Teach the language of creativity. Socialise the team into this language of creativity	It is vital that the participants are taught the creative language from the beginning of the programme.	Socialise the team into the language of creativity throughout the process.
11. Allow the participants to	Reflection, both individually	Allow moments of reflection. This

reflect on every stage of the process to enable the learning to become deeply embedded	and as groups, linked the learning process and allowed the participants time to ponder on their actions	may also be done through tools such as brain writing and talking stick. These tools may be integrated in the programme design.

#### 5.4 Chapter 5 summary

This chapter discussed the data analysis which was conducted during the research study. The chapter started by discussing the various stages of DBR and then described the data and the outcome of each stage, the iterations and the flow of the research. The enhanced design principles of project artistry which emerged were first tested first in the educational technology sandpit (ETILAB). The resulting enhanced principles were then tested in the multidisciplinary sandpit (ASLP). These principles were further specifically enhanced with the use of tools and artistic exercises in order to emphasise the points highlighted in the previous iteration. The resulting projects artistry design principles are presented in Table 10 below. The principles informed the project artistry framework proposed in Chapter 3.

## Chapter 6: Discussions

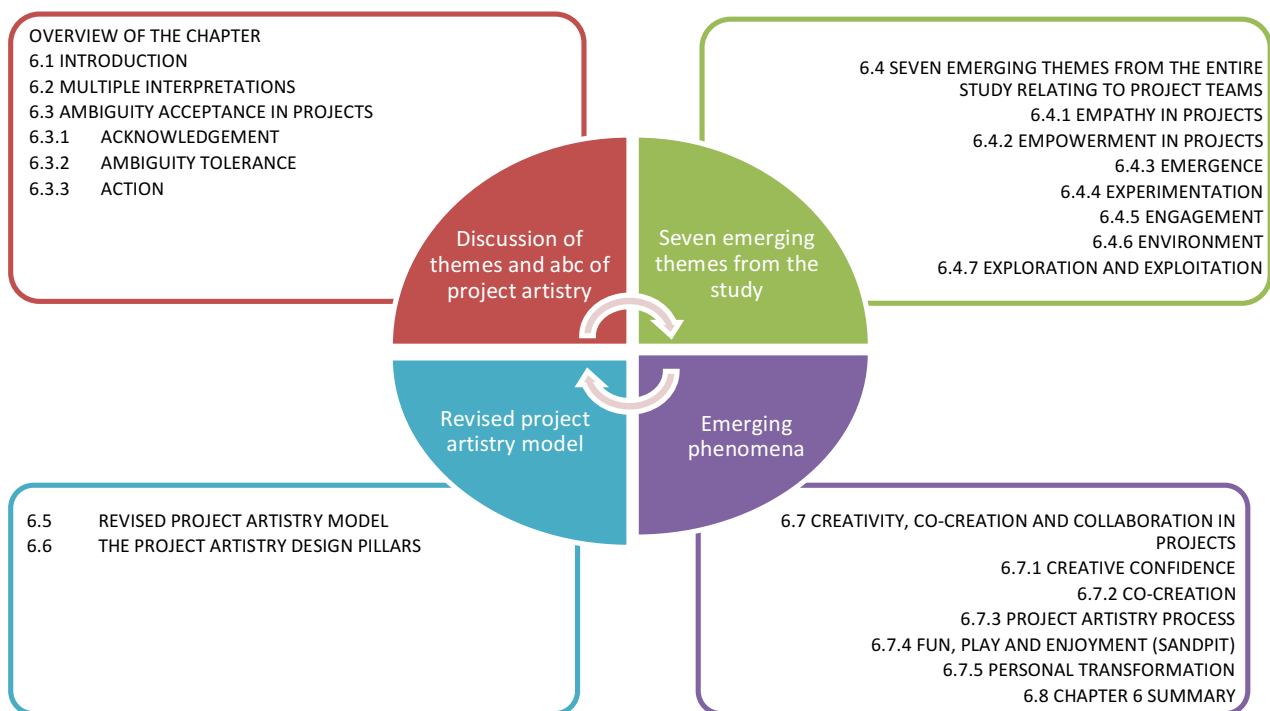
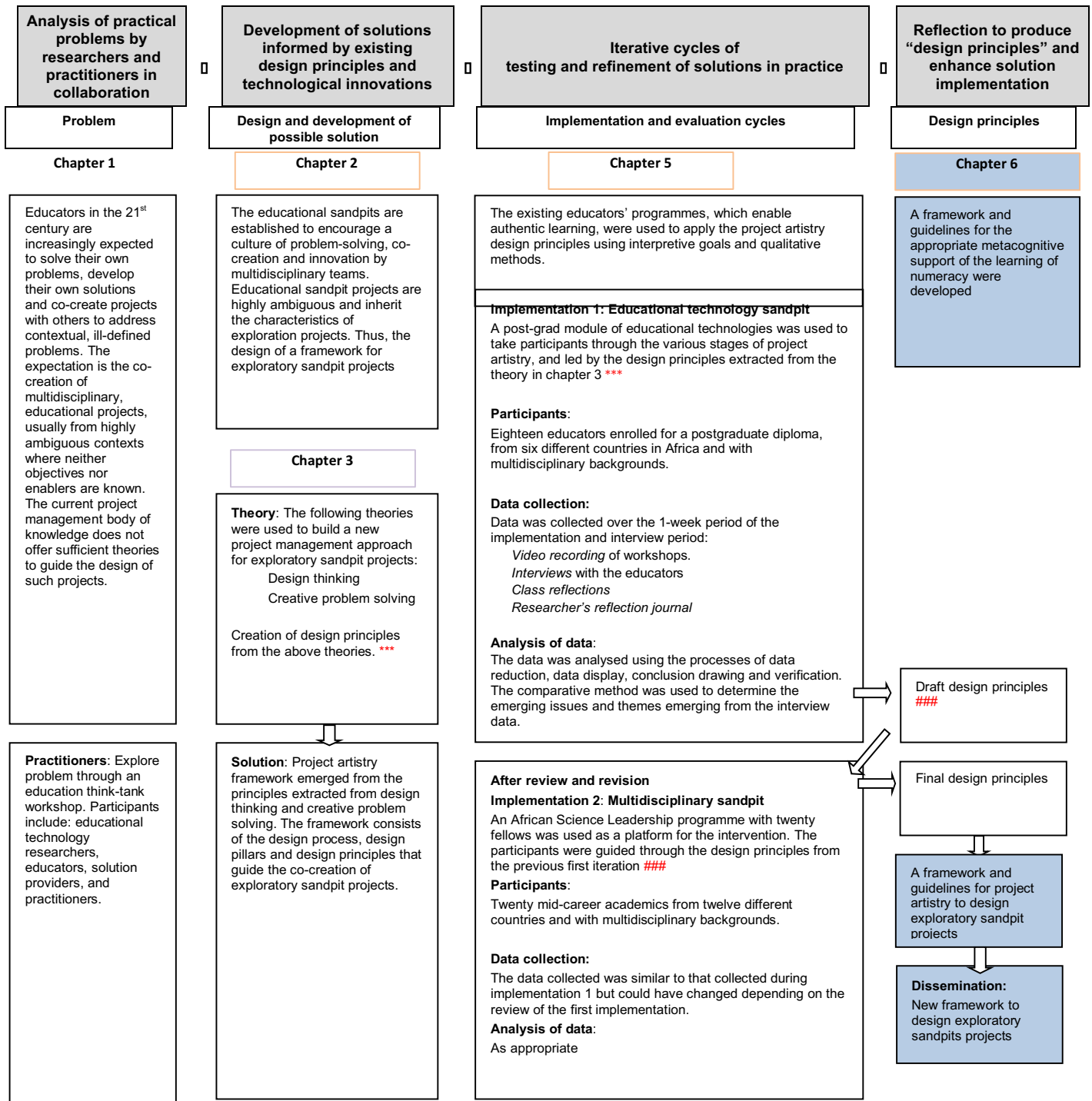


Figure 48: Overview of Chapter 6



## Chapter 6: Context within the thesis framework

(Project Artistry Framework for Exploratory Sandpit Projects)



(Adapted from Reeves (2006, p. 59))

## Overview of the chapter

This chapter discusses the findings further to establish how the design principles may inform the project artistry framework as well as the emerging themes and outcome of the study.

### 6.1 Introduction

In Chapter 2, I discussed Klein and Myers's (1999) list of seven principles of interpretive research and specifically for analysing ICT processes and social interactions in higher education (Klein & Myers, 1999, p. 72). These principles were deemed relevant for the purposes of this study as the study investigating both a process and the design principles guiding a process of creation. Hence, they were adopted in order to guide the understanding of the research topic and the analysis of the findings. The principle of interaction between researchers and subject/s suggests that insight in research emerges from the interactive process between the researcher and research subjects (Klein & Myers, 1999). The research methodology adopted for this study took into account the role of the researcher, the practitioners and the subjects. In view of the fact that a co-creation process was involved, each role was clearly defined before the research was even started. Although I was the primary driver of the process, the research and the workshops, I made sure that I drew more from participants' feedback than from my own experiences, observations and pre-conceived ideas about the research subject.

### 6.2 Multiple interpretations

The principle of multiple interpretations requires a researcher to account for multiple viewpoints in an inquiry and to seek clarity on the motivations for these various viewpoints (Klein & Myers, 1999). This principle is closely related to the principles of contextualisation and of the researcher and subjects as stated above. In acknowledging and accepting the significance of historical, social and cultural contexts in shaping our perspectives of knowledge, interpretive research anticipates that people may attach various, and sometimes contrasting, meanings to similar concepts, terms or situations. Hence, the methodology adopted for the purposes of this study allowed for design and

iterations, disclosed the research journey with the practitioners and educators and was characterised by different stages with outputs that were recorded and agreed upon by both the researcher and the practitioner to ensure an alignment of thought and a common understanding of the concepts. This was made explicit in the chapter on the research methodology.

Chapter 3 discussed Hassi and Laakso's (2011) three-dimensional framework explaining the management perspective on design thinking. I then built on this body of knowledge to find more sources of design thinking literature in order to explore the concept of design thinking further and to identify key features of design thinking that could be applicable to project management. This was in accordance with the research question:

*How may design-thinking principles inform a framework for managing exploration projects?*

I also considered the key principles of creative problem solving that could inform the project management of exploration projects in order to address the question below, namely:

*How may creative problem-solving principles inform a framework for managing exploration projects?*

The study of the concepts of design thinking and creative problem solving resulted in multiples themes that led to the construct of the ABC of project artistry, which categorised the findings into twenty-six different themes of project artistry. These are presented in Table 10 and there is a graphical depiction in Figure 26 in Chapter 3.

My original intent was to build on Hassi and Laakso's (2011) three-dimensional framework, using the feedback received from the participants. Table 16 below presents each theme and its place in the project artistry framework. The three dimensions that emerged included practices, mentality and outcomes. Unlike the Hassi and Laakso framework, the thinking styles did not emerge although the outcome, or the result of the experience, was more prominent. Column 2 demonstrates the place in the project artistry framework, whether it is in the entry, design process, design pillar or a tool used in the

process. The third column shows an example of a comment which informed the relevant theme while the last column shows the dimension, whether practice, mentality or outcome.

Table 15: Emerging ABC of project artistry

	Project Artistry Theme	Project Artistry Framework	Comments from Participants	Practice/Mentality/Outcome
<b>A</b>	Ambiguity tolerance	Entry into the process	<i>"Coming to a place where I know few people, I didn't know so many people, I didn't know what to expect because I came from a different culture. The structure on the programme was based was very innovative and, at some moments, we didn't know where we were going and that created so much passion and enthusiasm. I really wanted to know where are we going. And that kind of guided mystery because it was not just mystery, you are not just in the jungle and all by yourself, we were guided, so it's a guided mystery, I would call it, so it made me safe in the unknown."</i>	Mentality
<b>B</b>	Brainstorming and imagination	Design pillar		Practice
<b>C</b>	Creativity, co creation and collaboration		<i>I expected to find people of equal intellectual occupations, to be stimulated, to create linkages and collaborations, to find myself within the environment of leadership, to get myself into the right frame of mind to see myself as a science leader and to work with others. I have found that, and more!</i>	Outcome
<b>D</b>	Diversity, discovery and decision		<i>This experience has shown me that it is possible and you do have to work with a diverse group of people to achieve it. I definitely learnt and picked up on characteristics of leadership.</i>  <i>I have been all over the world and I have not seen as much cultural diversity as I have this week. I did not expect the diversity and the instant connection we had as Africans and the shared heart in thinking about solutions.</i>  <i>The talk by Derek helped me discover a key concept, namely, that I can be a leader, and there is a need for me to make a positive shift.</i>  <i>I am delighted that I have discovered this network of people, who feel as strongly about these issues as I do, so we can start addressing them.</i>	Outcome
<b>E</b>	Empowerment		<i>I think, to me, it gave me an opportunity to develop some of the softer skills which you cannot get from that blasting and blasting that we are talking...</i>	Outcome
<b>F</b>	Fun and play	Tools: design process		Practice

<b>G</b>	Guided mystery	Entry into the design process	<i>And that kind of <b>guided mystery</b>, because it's not like just mystery, you are not just in the jungle and all by yourself, we were guided, so it's a guided mystery, I would call it, so it <b>made me safe in the unknown</b>.</i>	Mentality
<b>H</b>	Human-centric	Design process		Practice
<b>I</b>	Imagination, inspiration, intuition and Innovation		<p><i>The <b>programme base</b> was just very innovative and, at some moments, we didn't know where we were going and that created so much passion and enthusiasm</i></p> <p><i>The <b>aspect of innovation</b> has been wonderful. I have never experienced this kind of approach before. The best was actually brought out of us effortlessly.</i></p> <p><i>It's <b>impressive and inspirational</b> how everybody here is negotiating the diversity of backgrounds and experiences and, at the same time, identifying something that is unique and common to all of them. I go away feeling extremely inspired.</i></p> <p><i>The <b>inspiration</b> I come away with is seeing how empowered the fellows are to take up the leadership challenge. Perhaps they have all tried to do this previously and, after this week, they have the guidance to go ahead.</i></p> <p><i>But just bringing in those thought provokers, <b>inspiration</b>, and then afterwards you had the chance to really think deeply and discuss deeply with other group members.</i></p>	Outcome
<b>J</b>	Judgement on and off	Design pillar		Practice
<b>K</b>	Knowledge	Design process		Practice
<b>L</b>	Language of creativity	Design pillar		Practice
<b>M</b>	Making meaning	Design process		Practice
<b>N</b>	New perspective		<i>So, the perception that you got was not necessarily a bookish type of perception but then what you got ultimately was a message, which was then <b>shaped by views and opinions from different people</b>.</i>	Outcome
<b>O</b>	Openness and optimism		<i>This consciousness has helped me to <b>appreciate other types of people</b>.</i>	Mentality
<b>P</b>	Play	Design process		Practice
<b>Q</b>	Questioning	Tool: design process		Practice

<b>R</b>	Rapid prototyping	Design process: Project prototype		Practice
<b>S</b>	Synergy		<i>What enriched it more was that <b>there was a nice mix</b>, where you get people coming in, not to talk too much about the theory of leadership, not blasting and blasting but just bringing in those thought provokers, inspiration, and then afterwards you had the chance to <b>really think deeply and discuss deeply with other group members</b>.</i>	Outcome
<b>T</b>	Transformation		<i>From being part of the programme, <b>the way I communicate has changed</b>. It has really made the future seem more concrete in terms of what I can do, where I can do it and with whom I can do it.  Some of the activities I learnt here are things I can do with my students, like turning the problems into questions. <b>I will definitely use what I learnt here very productively</b>.</i>	Outcome
<b>U</b>	Unlearning and reflecting	Design pillar		Practice
<b>V</b>	Visualisation			Practice
<b>W</b>	What if	Entry into the process		Practice
<b>X</b>	Xenodochial	Entry into the process		Practice
<b>Y</b>	Yes and...	Design pillar: language		Practice
<b>Z</b>	Zoom out and in	Design pillar		Practice

As regards revisiting the ABC of project artistry, the comments from the participants revealed many more insights that led to new themes emerging. Most of these themes were outcomes of the model. These are presented in Table 16 above. Some of the themes were written altogether and some strengthened by the empirical studies and feedback.

The emerging ABC of design thinking is depicted in the figure below:

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
Ambiguity Tolerance	Brainstorming	Creativity, co creation & Collaboration	Diversity, Discovery, Decision	Empowerment
<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>	<b>J</b>
Fun and Play	Guided mystery	Human- Centered	Innovation	Judgment on & off
<b>K</b>	<b>L</b>	<b>M</b>	<b>N</b>	<b>O</b>
Knowledge Funnel	Language of Creativity	Making meaning	New perspectives	Openness & Optimism
<b>P</b>	<b>Q</b>	<b>R</b>	<b>S</b>	<b>T</b>
Problem Solving	Qualitative Research	Rapid Prototyping	Synergy	Transformation
<b>U</b>	<b>V</b>	<b>W</b>	<b>X</b>	<b>Y</b>
Unlearning & Reflecting	Visualization	Wicked Problems	Xenodochial	"Yes and..."
		<b>Z</b>		
		Zoom out & in		

Figure 49: Emerging ABC of project artistry

The next sections highlight the themes that emerged from the iterations and how they also inform the new enhanced project artistry framework. I also propose a framework for ambiguity acceptance in

projects. It was interesting to discover that the very first letter in the ABC related to ambiguity. While the purpose of this thesis was to develop a framework to manage projects with high levels of ambiguity to ensure greater clarity (Figure 1), it was therefore deemed useful to draw on some wisdom for the acceptance of ambiguity in projects.

### 6.3 Ambiguity acceptance in projects

Figure 1 in Chapter 1 clearly depicts the ambiguity and uncertainty inherent in exploration projects. Although there are only unknown variables with which to work, exploration projects are still perceived as projects as far as the body of project knowledge is concerned. The purpose of the thesis was to develop a framework that would bring clarity to the unknowns in these types of projects. The high level of ambiguity in exploration projects presents that initial compelled me to explore a framework that would address “*ambiguity acceptance*” in projects before discussing the design process.

In order to do this, the interviews with the participants included a question on their feelings about the ambiguity of the programme at the beginning. There was evidence from the feedback that the participants the ambiguity of the programme had caused some discomfort for the participants. This was clearly demonstrated in the comments (see below) the participants had made when asked how they had felt at the beginning of the programme when they had been told they would be guided through a process daily and that would lead to the development of mobile applications that would address problems in their field.

*How I felt at the beginning of the programme when I had no clue about the outcome or design of the programme?*

**Key themes: Apprehensive, daunted, curious, stressed, overwhelmed, shocked, ignorant**

*Comments from educational technology sandpit participants:*

❖ *I didn't have any clue, in the end I knew how to do it and I'm confident to go out and develop more*



apps.

- ❖ *The idea of creating an app: Curious but very apprehensive.*
- ❖ *It was a daunting task, we could not imagine ourselves developing an app within 5 working days – actually by Monday, there were 4 remaining days – but we went in with a positive, and with thinking design thinking, we launched ourselves into it.*
- ❖ *Not that at ease because I've never done anything like that, so I was a bit stressed.*
- ❖ *I was thinking 'oh dear, programming, I'm not gonna make this, I was thinking more it was intense programme.*
- ❖ *I went like, what! I was in shock because I imagined those kinds of things are done out there but not by me.*
- ❖ *When I started this week, I didn't even know what mobile learning was really, but being able to go through all the activities, then coming up with an app that can actually work on the computer, I really feel very, very blessed to be able to have these practical skills that I'm very eager to go out and try out.*
- ❖ *When you said that by the end of the week we will be creating an app, I was thinking to myself "Are they are out of their minds?" What's really going on because I don't know the secret behind these apps, it could be a lot, not even a week, it could take us even 3 months or so, even more, but after just the few sessions that we had, I was like, everything was coming into light as if it was God saying, "let there be light", and there was light, so that was exactly what was happening... With your help I felt more at ease.*
- ❖ *...the structure on which the programme was based was just very innovative and, at some moment, we didn't know where we were going and that created so much passion and enthusiasm and I really wanted to know where are we going?...*

The above comments from the participants in the educational technology sandpit led me to believe that, before engaging the project artistry design process; there must be a prior process for handling ambiguity and uncertainty. The diagram below depicts how ambiguity should be addressed before embarking on the project artistry design process.

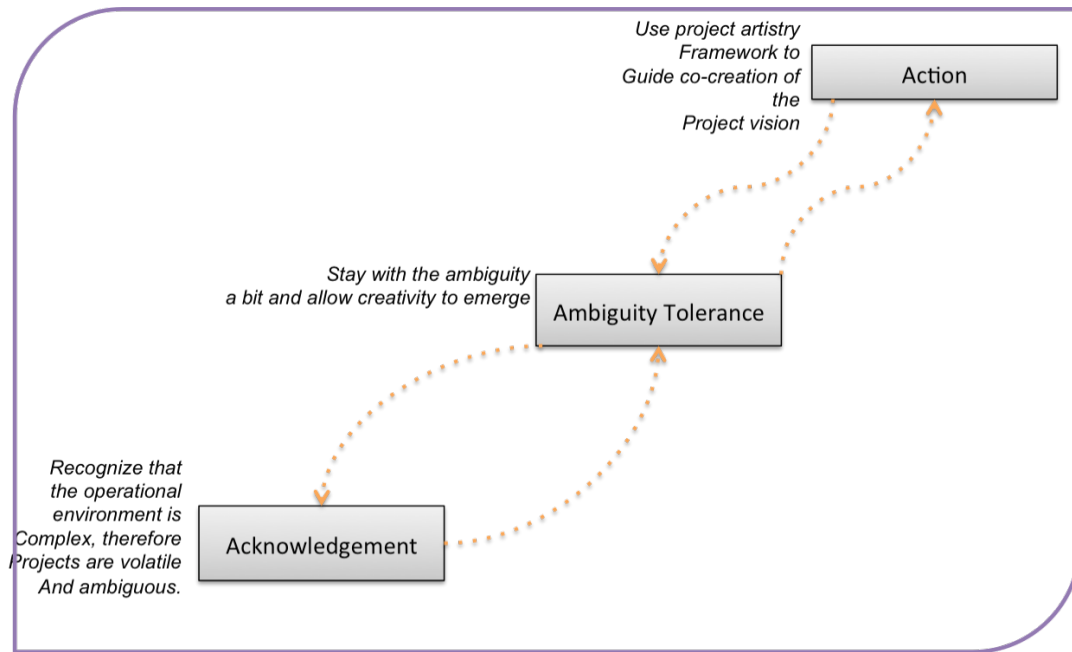


Figure 50: *Proposed ambiguity journey*

### 6.3.1 Acknowledgement

The ambiguity journey proposed in this thesis starts with an acknowledgement of the realities of the current operational environment, which is characterised by high levels of ambiguity, change, complexity and uncertainty. Human nature is more inclined to operate within structure and clarity and, in the face of obscure problems, many become ill at ease. However, recognising the truth that we live in exponential times will provide opportunities for new approaches to emerge. It must nevertheless be acknowledged that in the context of operational projects, no one knows what the objectives are or the problems. Consequently, the means or the skills to act are necessary in order to create anticipation and curiosity about the possible outcomes. This leads to the next stage of ambiguity tolerance.

### 6.3.2 Ambiguity tolerance

The next phase in the process is ambiguity tolerance, which involves accepting the reality of the project with its unclear objectives as well as one's responsibility to navigate through the fog, co-create

with others and tap into their innate creativity. Ambiguity tolerance is defined as a “willingness to accept a state of affairs capable of alternate interpretations, or of alternate outcomes” (English & English, 1958). In other words, ambiguity tolerance may be a critical link in operationalising a measurable and understandable personality trait that is central to creative thinking. In a study on the relationship between ambiguity tolerance and playfulness with creativity, Tegano (1990) suggests that implicit in the description of ambiguity tolerance is its association with creativity. Individuals who are intolerant of ambiguity are described as “disinclined to think in terms of probability” (Frenkel-Brunswik, 1948, p. 268) and have been found to solve problems without adequate information (Millon, 1957). This calls for individuals to remain curious, avoid assumptions and try to adopt an open-minded, curious stance. Dugan (2010) is of the opinion that it is possible to cultivate the capacity for ambiguity tolerance and that this will produce novel insights and distinct opportunities for innovation. One is then ready to move into the next phase with questions, curiosity and openness.

The comment below about the ambiguity of the programme captures this sentiment:

❖ *Coming to a place where I knew few people, I didn't know so many people, I didn't know what to expect, because I'm came from a different culture, the structure on which the programme was based was just very innovative and, at some moments, we didn't know where we were going and that created so much passion and enthusiasm and I really wanted to know where we were going. And that kind of guided mystery, because you know it's not like just mystery, you are not just in the jungle and all by yourself, we were guided, so it's a guided mystery, I would call it, so it made me safe in the unknown.*

### 6.3.3 Action

This stage involves doing something about a situation. The adoption of a framework that guides actions in a way that leads to deep problem understanding, an empathetic approach that embraces

multiple perspectives, asking the right questions that lead to discovery, unleashing individual creativity and drawing on the power of co-creation to draw from diverse groups in order to generate a contextually relevant solution is recommended. This is embodied in the project artistry framework proposed in this thesis.

#### 6.4 Seven emerging themes from the entire study relating to project teams:

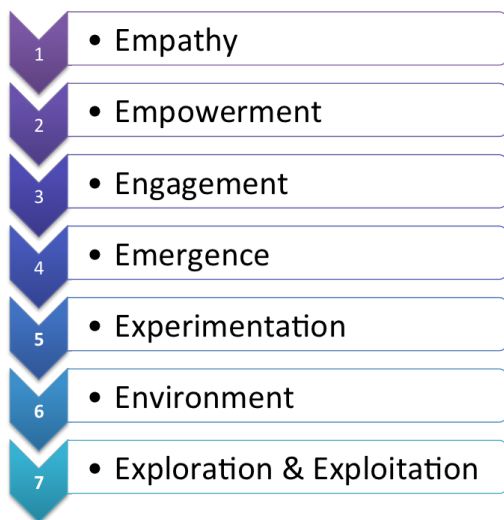


Figure 51: Emerging themes from feedback analysis

##### 6.4.1 Empathy in projects:

Empathy in projects refers to the ability to work so closely with the users that the project crafter/facilitator ensures that they move from a problem situation both to a place of ownership of the problem in question as well as co-creation with the project teams in order to reach a creative solution together. It is necessary to guide the user through a journey of seeing a problem as an opportunity to being introspective about the problem, gaining a different perspective about the problem and feeling empowered to co-create a solution with the project team. The comments from the participants in both the empirical situations highlighted that building empathy into the problem-solving situation facilitated an openness to user participation and input. This resulted in the solution providers walking a selfless journey with the users – a journey that capitalised on the users' experience and input and

ensured co-creation and empowerment of the users in that they were part of the problem solving.

The practitioner echoed this when he stated:

*# Empathy allows the user to be introspective about the problem, to see it using a different lens and, therefore, become part of the solution creation” Ng’ambi (2014).*

One of the comments from the participant cited below indicated a new understanding of empathy as well as the ability to forget one’s own experiences and subjective thoughts about subject matter but, instead, to focus on another person’s problem and seek to see the situation from that person’s perspective:

❖ *“I have learned to offer a gift of active listening and seeking to see the world from other people’s perspective” Etilab participant.*

Thus, the design thinking principle of empathy encourages the use of observation, gaining insights and seeking a deep human understanding of what customers want. This entails seeking to walk in clients’ shoes, validating assumptions, asking penetrating questions, deep listening, connecting emotionally and empathising with customers. This is not the same as conducting a project requirements process, interviewing stakeholders or carrying out project focus groups or surveys. Instead, it is insightful observation, living in the customers’, experiencing their perspective and seeking to co-create with them in designing and delivering what they need. Ironically, projects rely on classic scope definition and requirements gathering processes that are often static, cursory and rely heavily on documentation (Duggal, 2010). Design thinking takes into account that it is difficult for people to articulate what they want and hence project artistry proposes that the project team observes, engages and empathises with the customers in order to gain insights and enable them to see their problem through a different lens.

Inherent in the process of seeing the world from another’s perspective is the ability to empower the

users to feel part of the problem-solving situation to the point that they do not feel that there is a divide between the problem-solving agents and themselves. This is because the project is conducted in such a way that the users are part of the problem-solving process as well as part of the project team. Thus, they are able to contribute everything they know about the project. This leads to the next section on empowerment.

#### 6.4.2 Empowerment in projects

The section above referred socio-cultural issues that may advantage some participants over others in brainstorming and in the co-creation process. One such advantage is empowerment as those who feel empowered may take over discussions, promote their own agendas, enforce their own ideas and control the groups. This is both risky and counterproductive in view of the fact that diverse groups are brought together in the interests of diverse input, to strengthen the outcome of the collaborations and to ensure multiple perspectives.

Hence, it is vital that the facilitator in project artistry regards the empowerment of all as a priority of the thinking space and that he/she is constantly aware of the level of engagement of individuals as well as the contributions that individuals make to the co-creation process.

The essence of this approach is that if all the participants feel empowered, they will engage in the process, make decisions, define and redefine together in such a way that they develop a deep sense of ownership over the final results and believe that they have made a personal contribution to them. However, this is not automatic as socio cultural issues such as education level, gender, race, experience, etc. often play a role in giving certain individuals an advantage in environments in which diverse groups come together for the purpose of brainstorming. The facilitator must therefore ensure an environment of thinking in which each person is empowered to contribute meaningfully to the process. The comments below highlight this assertion:

❖ *I don't even think we should call it a workshop or conference because it's so much innovative to be*

*called in such a very traditional way, that's how I look at it. It's been very productive, very..., it's free of any kind of intellectual or social or cultural threats, (and) it was very comfortable.*

The participants also felt empowered after the workshops. The comments below provide evidence of how the participants felt empowered and equipped to make changes outside of the workshop. Empowerment allows the participants in the process both to discover and to express skills that they had not thought they possessed effectively. They are thus liberated in both their thinking and in their creative potential. A future that seemed uncertain is filled with hope and potential.

- ❖ *This is going to change how I do things in future, I expected passive learning and presentations but I experienced active learning where we expressed skills that we didn't know were present. The facilitation was very interesting and I will transfer what I have learnt to my colleagues and students. It has changed my perception as a scientist and came at the right time.*
- ❖ *I've always felt that there is a gap, even in my own professional development. I felt that there was a gap with respect with issues to do with science leadership. I have taken some courses, business leadership and some other courses, but there was something which was missing, in these courses and I thought that this programme would help me to fill that gap.*
- ❖ *It has really made the future seem more concrete in terms of what I can do, where I can do it and with whom I can do it.*
- ❖ *Some of the activities I learnt here are things I can do with my students, like turning the problems into questions. I will definitely use what I learnt here very productively.*
- ❖ *It has been a very enriching experience*
- ❖ *I think, to me, it gave me an opportunity to develop some of the softer skills which you cannot get from that blasting and blasting that we are talking...*

### 6.4.3 Emergence

***“Out of intense complexities intense simplicities emerge” (Winston Churchill).***

***“All you can do is hope for a pattern to emerge, and sometimes it never does. Still, with a plan, you only get the best you can imagine. I’d always hoped for something better than that”  
(Chuck Palahniuk, Lullaby).***

The ambiguity and uncertainty about what may possibly emerge from diverse groups of people coming together and brainstorming and developing projects are related directly to the facilitator’s approach to emergence. As Churchill states in the quote above, in facilitating complexity and wicked situations, unpacking and repacking the context and building a vision in projects, simplicity emerges and it is in this simplicity that the group members tap into their innate, creative power to build projects or solutions that address the complexity. However, the team must be ready for the emergence and anticipate the results which will emerge from the journey which involves project artistry.

#### 6.4.4 Experimentation

Project artistry encourages productive play through organised experimentation. In other words, it is about learning from experimentation. The mind-set of play is important and also critical in order to free people up the need to be correct as this often results in being judgemental and rigid in their thinking. It is, thus, important to allow the free spirit of play, openness, fun, laughter and learning from mistakes.

In the educational technology sandpit intervention, this was a strong learning point as all the activities resulted in intentional learning, there were presentations by the groups throughout the process and there was interaction and learning curves in the midst of the process. One of the key features of the design thinking that project artistry embraces is the ability to reach a place where a tangible prototype is possible rapidly in order to have a feel for, experience and interact with the artefact, thereby ensuring a quick response and suggestions for developments. The co-creation process emphasises that the users must be a part of this creation process, as this will lead to their owning the solution and testing it from the perspective that it is their own creation as they participated in the creation process.

The comments from the practitioner below provide evidence of this:



*#The fact that the clients have participated in the co-creation journey makes them feel they were part of the solution and, when it is presented to them, they have a sense of excitement and anticipation and their response to it is not that of criticising but of building and modifying together.*

The project artistry journey starts with a question, a challenge, a problem or a gap but the end result is a tangible artefact or a project concept with more clearly defined objectives and the means to achieve these objectives than would otherwise have been the case. The project conceptualisation phase entails idea development, feedback and further refinement with the rapid prototype principles playing a key role translating these ideas into real products.

However, this is not automatic and the facilitator of such creative spaces is responsible for creating an environment that is fun and playful and, yet, focused and deliberate. This may be facilitated in many ways including exercises involving laughter and ice breaking activities that are playful and, yet, engaging and participatory. This leads into the next point on engagement.

#### 6.4.5 Engagement

The project teams must remain both engaged and focused and participate in the process by means of intense sessions that are aimed at addressing a contextually relevant problem that has not even been clearly defined into project concepts that are tangible and real. This task may be overwhelming. However, if the process is followed through, the facilitator is sensitive to the team's energy and constantly enables the engagement of both the left and the right brain; the process becomes exciting for the project teams. This is obvious in the comments below.

- ❖ *Even though this was longer than the average of three days, we did not get bored or tired, there was something new every day.*
- ❖ *I was very satisfied with the week; I was very excited and didn't have a moment of feeling 'why am I here' or 'I want to go home'.*

- ❖ *It was an active and engaging week. We were always active and participating in the process. It was an eye-opener on leadership skills and how to engage with people to achieve certain goals.*
- ❖ *I always have ideas (about things I want to do outside of my discipline), but I never had the platform to explore, describe and discuss these ideas. This experience allowed me to freely say what I'm thinking and to share ideas about research and science for the benefit of Africa – how to engage communities.*
- ❖ *This was beyond my expectation. I thought I would be coming here just to design projects, but the way we went about things to develop the project was really fascinating. It was not time or energy consuming, in fact, we did it in an exciting way.*

Osborn and Parnes (2010) refer to the notion of framing problems, challenges or gaps as opportunity statements that invite ideas and **engagement** rather than a feeling of being overwhelmed and burdened.

- ❖ *The process has been very engaging for all of us while developing the app for the client*

According to the statement above, in coming up with solutions in the design process, knowledge of the client is essential while the engagement of the whole self at both an intellectual and intuitive level in the process is vital in coming up with a solution that is client centric.

#### 6.4.6 Environment

It is essential that the feedback process in respect of the end result is positive as constructive feedback builds, empowers, develops, and strengthens the emerging solution. This was highlighted during the educational technology iteration during which the first groups presented received criticism from their clients. This created a tense environment with a lack of appreciation of the hard work that had been into developing the solution. The reflective notes from this point read as follows:

- \* *I should have set up a positive environment before they started rather than assume the clients would*

*automatically be appreciative! Lesson learned: ALWAYS provide guidelines on positive feedback mechanisms or use a creativity tool...*

Although this may be easier said than done, this principle helped to ensure the subsequent next groups did their presentations in a positive space with the discussions being guided toward more meaningful feedback and engagement both during and after the presentations.

It is also important to provide anonymous feedback mechanisms in terms of which people are able to contribute and comment without having to identify themselves. Tools such as [www.pollseverywhere.com](http://www.pollseverywhere.com) where the participants vote and also comment on each other's projects may help to ensure more openness than may otherwise be the case.

During the multidisciplinary educational sandpit, the creative feedback tool of “Pluses, Potentials, Concerns and Overcome Concerns (PPCO)” was used to guide the feedback process from the workshop participants. This immediately equipped them with a language and the communication style that led to a positive, empowering feedback session.

#### 6.4.7 Exploration and exploitation

As noted in Chapter 2, in the alphabet of design thinking, the A stands for ambidexterity. According to Martin (2008), ambidexterity refers to the ability to use both the left brain and right brain in problem solving. Martin (2008) maintains that organisations must learn to embrace the analytical mind as much as the intuitive or creative mind.

Project artistry involves creating an intersection between art and science and embracing the analytical mind as well as bringing artistry into play. There is a general belief that the education system is based on systems that develop the analytical side although this may risk killing the creative, more artistic innate power, especially in the context of projects.

It is therefore important to facilitate the “divine dance” between being analytical and artistic in the

workshops. This was demonstrated in the second multidisciplinary sandpit where artistic exercises were used to unleash individuals' creative power in order to create confidence in both their creativity and that of others.

## 6.5 Revised project artistry model

### 1. Application of the hermeneutic circle principle

*"Hermeneutics is about interpretations and making sense of meanings" (Lee, 2004).*

The perception of research as a hermeneutic process enables the scientist to focus on how far to enter into the research process itself in order to improve the understanding but without compromising the validity of the enquiry (ibid.).

In Chapter 3 I explored an illustration of one-way of understanding how hermeneutics combine synthesis and analysis: synthesis is the process of combining the parts to make a whole while analysis is the reciprocal process of dividing the whole into its parts.

In view of the fact phenomena are subject to various interpretations, the hermeneutics principle focuses particularly on iterations between the interdependent meanings of various parts of a phenomenon in relation to the whole that they form. The principle of the hermeneutic circle applies the iterative sense-making process between the terms and their meanings within a context relating to the interpretation of phenomena. Firstly, I needed to understand the phenomena of design thinking and creative problem solving holistically. By using analysis, I was able to break down the principles of each into parts that would guide the project artistry model. The ABC of project artistry then emerged. I then synthesise all the parts to create a holistic model which would result in a new approach to projects. The same process was repeated in the practical application of this framework in the iterations discussed in the methodology chapter.

The original model for project artistry was simplistic and focused on process whereas, during the analysis phase, new core principles emerged that proved to be fundamental to the framework. The new construct of project artistry is depicted in Figure 53 below, which incorporates the results from the analysis phase and the themes which emerged. The construct of a house reflects a more holistic framework consisting of a roof (design process), the pillars that hold up the roof (design pillars) and the foundational bricks and based on the seven themes that emerged and were discussed in Chapter 5.

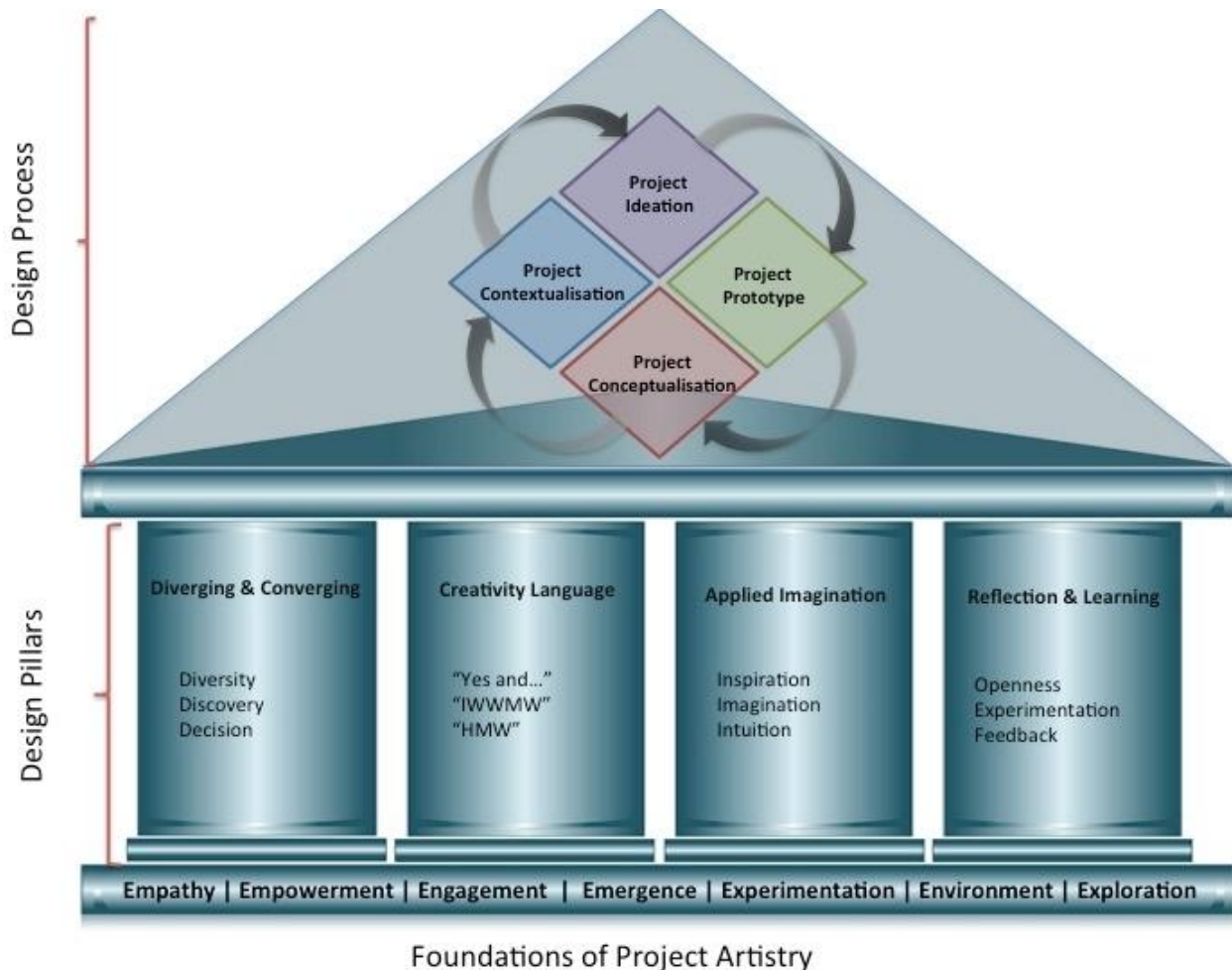


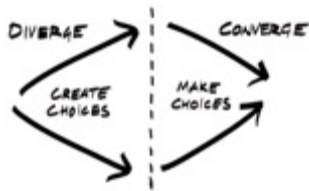
Figure 52: Emerging project artistry framework

## 6.6 The project artistry design pillars

Based on these design principles I extrapolated to the design pillars of the framework and how these

design pillars inform artistry in projects. I named them pillars because I believe they hold the entire project artistry experience together and, without them, it would not be possible to really engage the creative minds of the project team members.

## 1. Diverging and converging



The creative problem-solving process is founded on the basic principles of diverging and converging as the original developers of the model believed that creativity is based on the ability to control the group to ensure that the group members know when they are in a place of diverging and also the rules of diverging. These rules include switching off the judgemental brain, being fully open-minded to ideas, seeking quantity of ideas rather than quality, building on each other's ideas and searching for wild ideas. It is then important to realise when it is time to take a stance, converge, make decisions and seek the quality and uniqueness that leads to novelty, feasibility and viability (Parnes, 1980).

If these two processes are not incorporated into the design process, it may be challenging to generate new insights about the challenge, build novelty in solutions and explore multiple ways of making a solution a reality. It is, therefore, critical to ensure that both diverging and converging inform the entire process and that the participants are also socialised in this practice, whether through tools, artistic exercises or the play that reinforce learning about this pillar.

The process of diverging allows a diversity of opinions about the subject in question. It is this diversity of contribution that enables the teams to discover new insights while suspending judgement during the diverging process enables discovery.

The converging process facilitates taking a stance and making a decision as a team. This part of the

process cultivates a fertile ground for the decision making that leads to productivity and progression.

### Communication and Language

Language is an extremely important aspect of facilitation and, if overlooked, there is the risk of a negative environment that does not embrace new thinking and novelty. This may lead to the even more detrimental effects of fear and insecurity which breed discomfort, criticism and a lack of desire to create and innovate. Osborn and Parnes (2010) refer to the notion of framing problems, challenges or gaps as opportunity statements that invite ideas and engagement rather than a feeling of being overwhelmed and burdened. They propose the use of the phrases “How might we?” (HMW), “In what ways might we?” (IWWMW) or “How to?” (H2) at the beginning of problem statements in order to frame them positively in a way that invites solutions.

The empirical study in the educational sandpit and during which this approach was not engaged from the beginning demonstrated the need for continuous reflections and modifications of the process in order to encourage greater positivity. However, this approach was incorporated in the more refined intervention in the multidisciplinary sandpit, where it was embedded at the beginning with the language used during the whole week being altered to reflect this phenomenon.

This also applied in the use of the *PPCO* for feedback process where language was positive, encouraging, building, empowering to ideas presented. Starting from a positive note and voicing concerns as challenge statements that invite solutions are key to the process.

In general, the language of creativity tends to be more positive and supportive although this should not be misinterpreted as being too nice or going easy in respect of ideas that require rigorous improvement. It simply means the approach is productive rather than destructive and the vocabulary used is generous rather than sceptical. It is important not to underestimate the impact of language on creativity, as it is amazing how just a few words may result in the right frame of mind to generate new possibilities.

## Applied imagination

*“I believe in intuition and inspiration. Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution. It is, strictly speaking, a real factor in scientific research”. No reference*

Osborn studied creative people to identify the process of how they naturally create good ideas. With the goal of approaching problems with greater imagination, he incorporated his findings into the first versions of the CPS process. He helped people to learn how to be more deliberately creative (CEF Resource Guide, 2015).

In his work, *Applied imagination*, Osborn (1954) maintained that imagination should be applied by questioning existing assumptions and boundaries and investigating an idea through a series of real-world interventions and feedback. In the words of Bateson (1960), “change goes on, surely the central task of our learning is not to confirm what is but to equip ourselves to meet that change and to imagine what could be...” Hence, ongoing exercises, activities, and tools should be used in every phase of the process to encourage the participants to use their imaginative power. The practice of imagining the future and designing project today that address future needs is a strong pillar of project artistry. Whereas many projects management processes encourage highly analytical approaches, which draw on knowledge and evidence based in the past, project artistry encourages a more imaginative approach in terms of which intuition and inspiration are embraced during the process.

## Reflection and learning

We do not learn from  
experience... we learn  
from reflecting on  
experience.

- John Dewey

Learning is key to project artistry as each stage entails a learning process on the part of both the facilitator and the co-participants. Learning new ways of seeing, being



and thinking enables groups to work together and to be productive within fixed time. There may be a need to learn other disciplines, technologies, or skills in order to develop a prototype without deploying expensive resources, especially in a context in which a lack of resources is one of the main problems. In such a context, the participants are encouraged to be productive within the constraint of the resources and access available. The educational technology sandpit encouraged the participants to learn the mobile application development within a very short time in order to develop prototypes that the client could experience to allow feedback before the full development of the prototype. In addition, reflections encourage mindful meditation of the learnings and enable the experience to be internalised.

In both iterations, daily reflections on the process, the experiences and the learnings linked the programmes together into an educational and empowering experience that led the participants thinking deeply about their actions during the process and what they had valued, struggled with or embraced the most during the journey. In addition, they also thought about how they may have done things differently based on the experience they had just had.

This reflective practice will ensure bring the transformation is at a personal level. This issue is discussed at length in the next section on transformation. There are several models of reflective practice. Knowledge of these models may help with maximising the learning from any experience. This is because these models assist in deconstructing experiences and helping to ensure that the right reflective questions are asked during each stage of an experience. In addition, the models of reflective practice may be used as a basis for the structure of a reflective essay.

As already stated, there are many models of reflective practice that may be embedded in a framework in order to facilitate deep personal learnings as a result of the reflection. Schön (1991) maintains that cultivation of the capacity to reflect both in action (while doing something) and on action (after you have done it) has become an important feature of the professional training programmes in many disciplines. This practice constitutes a strong pillar of project artistry.

### 6.7 Creativity, co-creation and collaboration in projects

In order to assess the impact of the process and framework on a personal level, I reflect below on the comments on the way in which the participants perceived themselves and others after the programmes.

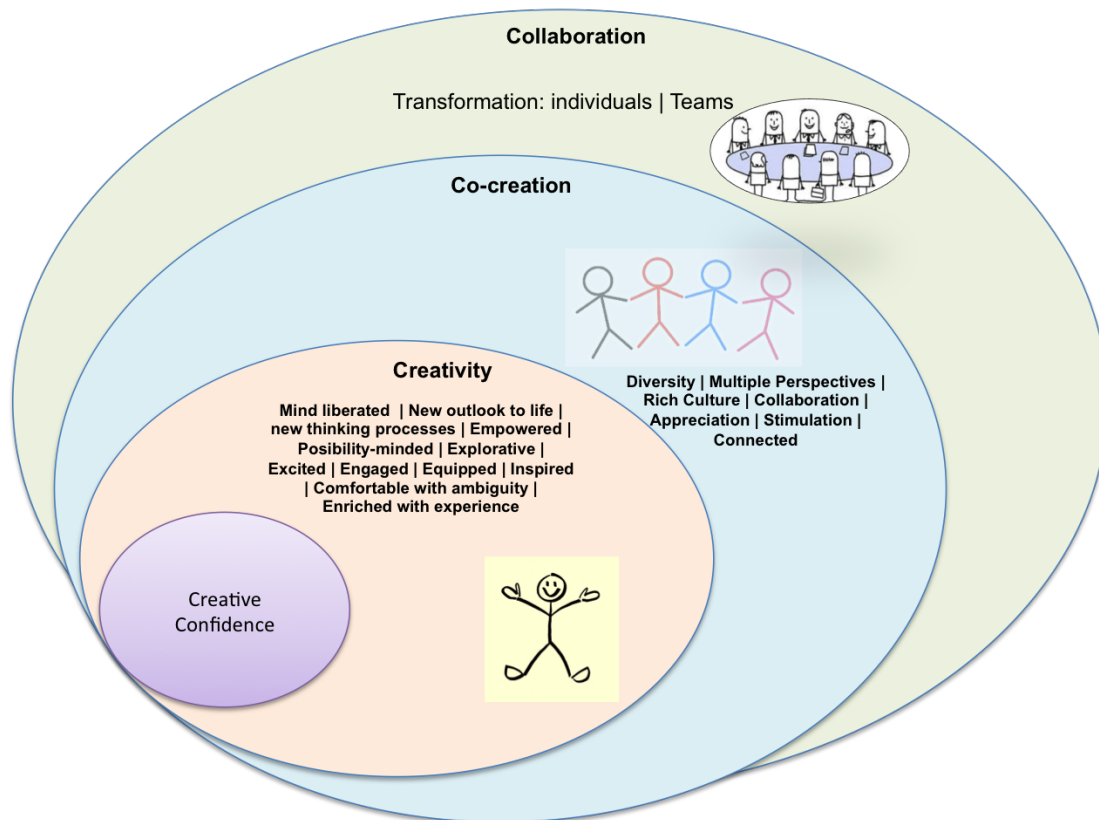


Figure 53: A Model for Creative confidence

Comments of the participants which related to the project artistry design principles:

The comments captured via the audio reflections in class and the video interviews held after the course were transcribed. Appendices 9 and 16 has all the comments about each category but below are summaries of the comments relating to the various themes.

These comments are grouped according to the themes:

1. How I see myself now (Creativity)
2. How to work with others (Co-creation)
3. What I think about the process (Project artistry)
4. Fun play and enjoyment (Sandpit)
5. Personal transformation

### 6.7.1 Creative confidence

The issue of creative confidence was extremely evident in the participants'. The themes which emerged from the comments on the way in which the programmes had impacted on their lives are summarised below:

**Mind liberated, new outlook to life, new thinking processes, empowered, open to possibilities, explorative, excited, engaged, equipped, inspired, comfortable with ambiguity, enriched by the experience.**

These themes provide evidence of the impact of the framework at a personal level. The change in mind-set is explicit in the comments as the positive energy and excitement at an individual level.

*How I see myself now...*

- ❖ *I have always known **I am a creative** and that was nice but it was also nice to take my thinking process and actually put into a “bottle”, knowing what I’ve been doing.*
- ❖ ***My thinking has definitely changed** – the way I look at things, the way I look at problems. That’s the main thing I’ve gotten here and the experience of actually using an app and believing that you can do that in few days and it can be used by other people to solve problems, thank you.*

- ❖ *Now, I actually feel that the sky is not the limit because, if we can do in couple of days with the client... what could we do with more time?! I'm looking forward to designing an application.*
- ❖ *I've enjoyed this module in such a way that it has changed my way of thinking and I see myself as a problem-solver out there.*
- ❖ *This course has really inspired me to tap into my creative side which I really didn't think that I had and I think it an amazing way to get me to find solutions and to be creative about the solutions that I find to the challenges that I identify. Normally when I had look at finding solutions it used to be a very boring kind of plotting, a long way without looking*
- ❖ *This is going to change how I do things in future, I expected passive learning and presentations but I experienced active learning where we used skills that we didn't know we had. The facilitation was very interesting and I will transfer what I have learnt to my colleagues and students. It has changed my perception as a scientist and came at the right time.*
- ❖ *The inspiration I come away with is seeing how empowered the fellows are to take up the leadership challenge. Perhaps they have all tried to do this previously but, after this week, they have the guidance to go ahead.*

The comments above provide evidence of the rich, personal experience that resulted in increased creative confidence, personal growth, openness, and empowerment. Information about how the participants felt about co-creation and the value of group work was extracted next.

### 6.7.2 Co-creation

I took the aspect of co-creation a step further and looked for comments relating to others in the groups, working together and co-creating. The following themes emerged.

Diversity, multiple perspectives, rich culture, collaboration, appreciation, stimulation, connected

Insights into collaboration, the richness of working together and a positive energy and spirit in teams emerged from the themes.

### **Comments about teams**

- ❖ *With this module I think it really help so much, I like the comment that we came from different contexts and we really needed to come up with authentic mobile apps for our context as Africans should develop mobile learning apps that are suitable for their context.*
- ❖ *I thoroughly enjoyed the entire process of working with the client and trying to see what we could do together in order meet to the demands they had and the challenges.*
- ❖ *I benefited significantly from the group learning this week and my horizons have broadened tremendously in terms of what may be done in my context with mobile technologies.*
- ❖ *What enriched it more was that there was a nice mix, where you did not get people coming in to talk about the theory of leadership too much, not blasting and blasting but just bringing in those thought provokers and inspiration, and then, afterwards, you had the chance to really think deeply and discuss deeply with the other group members.*
- ❖ *I have been all over the world and I have not seen as much cultural diversity as I have this week. I did not expect the diversity and the instant connection we had as Africans and the shared heart in thinking about solutions.*
- ❖ *The profile surveys helped me to be more patient working with others and encouraged me to ask how saw myself. This consciousness has helped me to appreciate other types of people.*
- ❖ *I expected to find people of equal intellectual occupations, to be stimulated, to create linkages and collaborations, to find myself within an environment of leadership, to get myself into the right frame of mind to see myself as a science leader and to work with others. I have found that, and more!*
- ❖ *It was so amazing to see how many people were connected by a common and a shared vision of the programme and of the projects. I am looking forward to getting something tangible out of this project*

- ❖ *It's impressive and inspirational how everybody here was negotiating the diversity of backgrounds and experiences and, at the same time, identifying something that was unique and common to all of them. I go away feeling extremely inspired.*

The comments above demonstrated the richness of the teams' synergy, collaboration and co-creation when people from diverse backgrounds and who, in some instances, had never met before, may easily bond, trust one another and open up to possibilities. I then extracted the participants' views on the project artistry process.

### 6.7.3 Project artistry process

These themes below emerged from the comments on the process.

#### *Comments about the process*

#### **Engaging, liberating, opened mind, practical, experiential, feedback, involving**

- ❖ *The process was very engaging for all of us while we developed the app for the client*
- ❖ *The design thinking process: it opened my mind..., it liberated my mind. It has changed my whole outlook.*
- ❖ *It was a process, actually, because I think we came up with a 'really cool app' and then a 'cool app' and then, one evening I suddenly thought "Oh, the cool group wanted a 'Scool app'", so "Scool app" evolved.*
- ❖ *I benefited a lot from the theory and practice that we went through and the whole process of thinking and diverging and converging until we came up with a solution, I've also benefitted from so many things, I was able to adapt marketing skills because you had to convince your client to take up something. So, it was not only about educational technologies but how you could market your product and how you could understand your client and convince them and produce something they could accept.*
- ❖ *I'm am going to echo a lot of what people said: I really enjoyed the quite excellent mix of theory and practicality that we experienced in this module, I thought Puleng was great and*

- that whole design thinking process, that was very unexpected and, I think, very beneficial.*
- ❖ *It's not only about just finding technological solutions, it's what we learnt, the process of getting to the point and then one starts to apply the technology...*
  - ❖ *I'm happy we are not here just to learn, but we've actually lived the experience of learning, I liked the design thinking process and all the activities*
  - ❖ *I thoroughly enjoyed the entire process working with the client and trying to see what we could do together in order to meet their demands and the challenges.*
  - ❖ *... and the design thinking process, the way that was delivered to us and the practical experience that we had to work through. I think I will take that with me and practise it. I really enjoyed it.*
  - ❖ *It's been a very interesting week, Puleng, we've learnt so much about using creative design to create apps for the problem that was given to us by our colleagues.*
  - ❖ *I think what was really great about this course was the practicality of it and the actual application, so it wasn't just sitting and listening to somebody, we actually built something and, through the process, we learnt from an experiential perspective which was great.*
  - ❖ *I really enjoyed learning about the processes and developing apps, the science behind it and I really did enjoy the practical application of it with the clients, the whole process of presenting to them, getting feedback, making changes and improving.*

These comments demonstrated clearly the powerful impact the process had had on the participants. Several themes emerged from the comments including engaging, liberating, opened mind, practical, experiential, feedback, involving.

I then extracted themes relating to fun, play and enjoyment.

#### 6.7.4 Fun, play and enjoyment (Sandpit)

Sandpits are supposed to be fun, playful and experiential places. The comments below captured the spirit of the sandpit.

**Comments related to fun, play or enjoyment**

- ❖ *Awesome course, awesome planning.*
- ❖ *It was very interesting, I enjoyed that very thoroughly.*
- ❖ *Thank you for the passion, it's contagious!*
- ❖ *I can't sum it up better than that it's been really great and I really enjoyed the practical application that we've been learning about in class. I hope that our clients are just as happy as they were early in the class.*
- ❖ *I thoroughly enjoyed the entire process working with the client and trying to see what we can do together in order to meet their demands and the challenges.*
- ❖ *I think I will take that with me and practise it. I really enjoyed it.*
- ❖ *I've enjoyed this module in such a way that it has changed my way of thinking and I see myself as a problem-solver out there.*
- ❖ *It's been a very interesting week Puleng, we've learnt so much about using creative design to create apps for the problem that was given to us by our colleagues.*
- ❖ *I really enjoyed learning about the processes and developing apps, the science behind it and I really did enjoy the practical application of it with the clients, the whole process of presenting to them, getting feedback, making changes and improving.*

The above comments eluded to enjoyment, playful and fun environment created in the co-creation process. The sandpit by nature is fun and playful, and in this context productive and leading to innovative results.

**6.7.5 Personal transformation**

Finally, I looked for comments relating to personal change and transformation. The following comments reflected transformation, personal development, connection with purpose and new perspective.

**Comments reflecting transformation**



- ❖ *It has **changed my perception as a scientist** and came at the right time.*
- ❖ *I've always felt that there is a gap, even in my own professional development. I felt that there was a gap with respect with issues to do with science leadership. I have taken some courses, business leadership and some other courses but there was something which was missing from it and I thought that **this programme would help me address to fill that gap.***
- ❖ *It has really **made the future seem more concrete in terms of what I can do, where I can do it and with whom I can do it.***
- ❖ *Some of the activities I carried out here are things I can do with my students, like turning the problems into questions. **I will definitely use what I learnt here very productively.***
- ❖ *I think it gave me an opportunity **to develop some of the softer skills** which you cannot get from that blasting and blasting that we are talking...*
- ❖ *From being part of the programme, **the way I communicate has changed***
- ❖ *I never viewed myself as a leader to be honest ... and one thing that this week emphasised to me is, **I am actually a leader, not only in the projects I lead but also with my postgraduate students.***
- ❖ *The talk by Derek helped me discover a key concept, namely, **that I can be a leader, and there is a need for me to make a positive shift.** I keep reflecting on the video that was played that made me feel 'I can do it' and that there is a need for a change and out of the box thinking*
- ❖ *... **to get myself into the right frame of mind to see myself as a science leader and to work with others.** I have found that, and more!*
- ❖ ***There have been a lot of hands on activities that invoked thinking.** I know I am in the right place, I have gained a lot and I feel that the ball has been set in motion.*

This exercise helped me to investigate the project artistry framework and its potential to change culture and behaviour. Discovering the transformation that had taken place in the participants as they engaged in the process was invaluable. It gave dimension and depth to project artistry. The

comments above indicate a sense of personal transformation of the project team members as they engaged in this process. They stated that they would approach projects differently in the future and that the course had resulted in both personal growth and learning for them. This, thus, suggests the possibility of a new project culture that will empower people, inspire them and help them to embrace the uniqueness of the various contexts and appreciate multiple perspectives and diversity. However, this is not only applicable to exploration projects but to all types of projects which are in desperate need of inspired and engaged teams.

## 6.8 Chapter 6 summary

This discussion chapter uncovered emerging concepts, themes and learning from the two iterations. The chapter also highlighted links between the concept of the ABC of project artistry and the comments from the participants, thus revealing that a full circle had been experienced. In addition, however, new emerging themes were applied to rethinking the ABC of project artistry and also expanding the original framework.

## Chapter 7: Conclusion and Evaluation of the Study

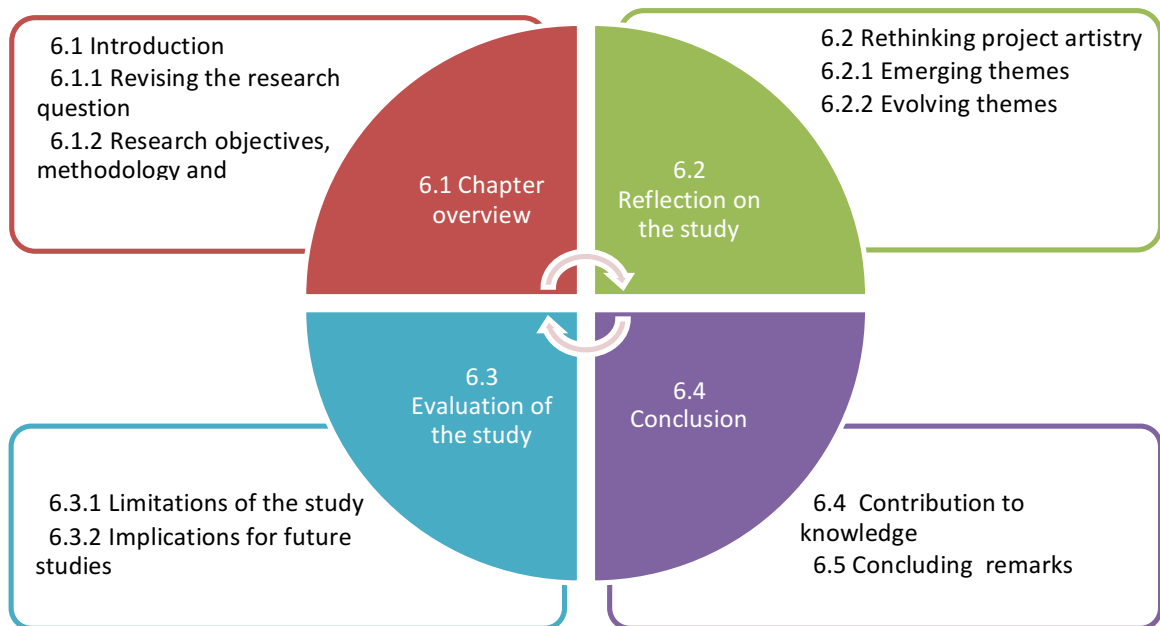


Figure 54: Overview of Chapter 7

## Overview of the chapter

This chapter concludes the study by first discussing the research journey and then the research questions and the way in which they were addressed in the thesis. I then deliberate on my personal learnings and the contribution of the study. I also discuss reliability and validity of the study. Finally, I make recommendations for proposed future research.

### 7.1. Application of project artistry framework in the thesis

I had an opportunity to apply the very design process which emerged from this study in the research journey. I was also able to engage in an exploratory study with the aim of developing a framework for managing complex exploration projects.

An important question to ask is: Are intrinsically unpredictable environments becoming more dominant leading to increase in the complexity of projects? We are now living in a volatile, uncertain, complex and ambiguous (VUCA) world, can project management as a field overcome significant barriers to change and develop the capacity for more subjective, interactive, and interpretive innovations that appear to be more effective in these settings? This thesis is an attempt toward a framework that is used to manage under such circumstances.

New approaches to project leadership and design are essential to transform the world we live in. Although no panacea, project artistry provides project leaders with a new dimension to understanding the changing conditions that surround their project and envisioning better, innovative solutions to some of the most troublesome challenges facing our projects. It can bring together the power of analysis and intuition to synthesize real solutions that not only work but meet the needs of the people and are innovative. This fresh approach also brings enlightenment and transformation to those engaged in such projects and cultivates creative confidence and fosters collaboration.

The journey of this thesis itself has been that of a project artist. It started with high levels of ambiguity and uncertainty and the framework has guided me to move from mystery to heuristics, the iterations

in real settings have granted me an opportunity to define, and redefine, learn and unlearn, discover and rediscover, exploit and explore and most accurately, I walked the journey of an artist captured in a statement below:

***“walker, there is no road, the road is made by walking”***

Translation from the poem Cantares by Antonio Machado (2003)

Quoted in Spanish by Stafford Beer (2004, p. 863)

In concluding this study, I wish to reflect on my research journey. To do so I will use Figure 54 below, which is a graphical depiction of the journey I have undertaken.

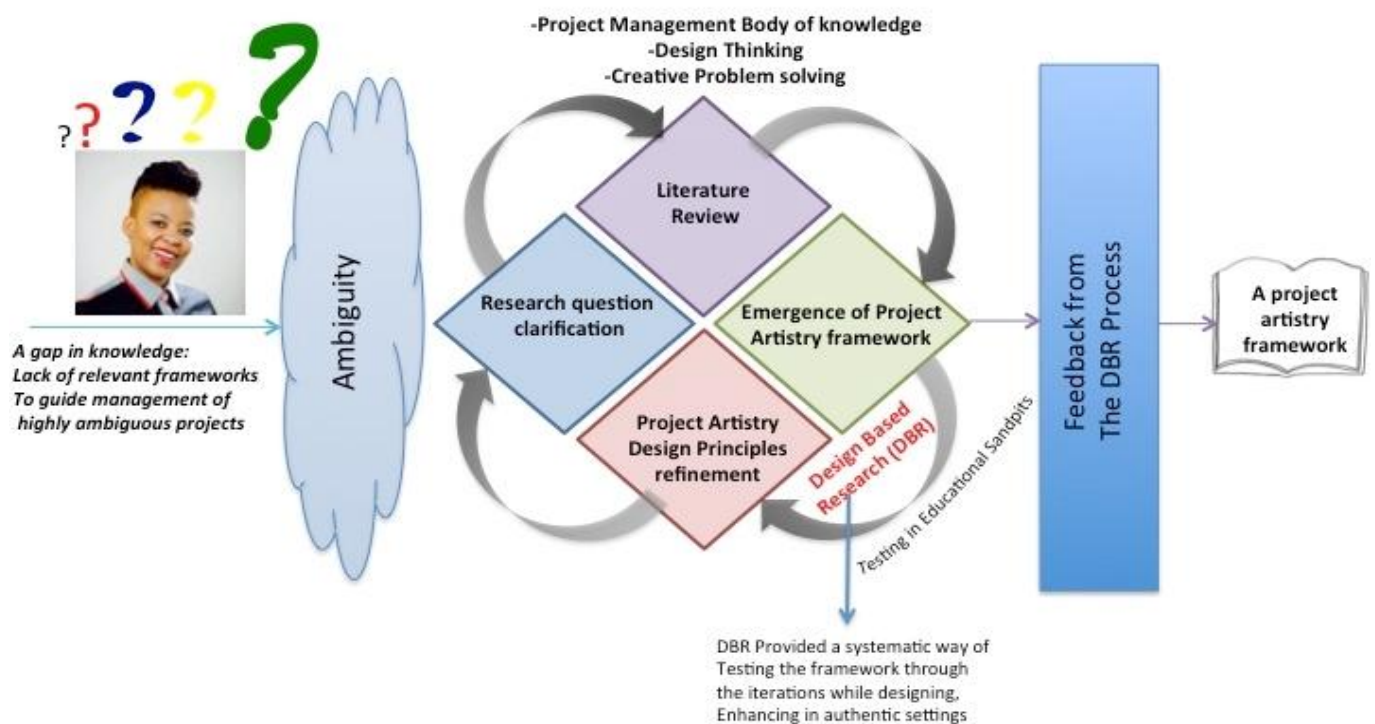


Figure 55: Researcher's journey

In Chapter 1, I discussed the motivation for this study, the research objectives and the original research question. I also disclosed my positionality and my role on the study and summarised the research journey on which I embarked.

Chapter 2 contained the literature review which identified both the knowledge gap in existing project management and the overarching need to develop a framework for exploration projects. I discussed the research context, namely, the education field, in which educational sandpits have emerged. The aim of these sandpits is to address the wicked problems that exist in education. Section 3.3 explained that educational sandpit projects are, in fact, exploration projects and, therefore, a justifiable context in which to test the project artistry model.

Chapter 3 discussed the emergence of design thinking principles and creative problem solving. Design principles were extracted from these two phenomena and formed the basis for the ABC of project artistry, which incorporates twenty-six different concepts in project artistry. These concepts informed a framework that may be used to manage exploration projects. The emerging framework of project artistry was discussed at length and then eleven design principles were extracted for the purposes of this study which used the DBR methodology described at length in Chapter 4.

In Chapter 4 discussed the research methodology used in the study with DBR being adopted as the method of inquiry. This methodology enabled plausible iterations of the project artistry design principles in authentic settings. The first iteration was in an educational technology sandpit where educators from diverse backgrounds, and different countries in Africa, and with no previous knowledge of programming, were assigned to groups and tasked with co-creating mobile applications that would solve contextually relevant problems in education and using the design principles emerging from this thesis. The results were captured in various ways and then analysed (see Chapter 5). These results then informed the design process used in the next iteration.

The second iteration was in the multidisciplinary sandpit, where educators from across Africa and diverse backgrounds and disciplines were enrolled in a one-week programme to co-create multidisciplinary projects that would address the issue of the leadership in academia in Africa. The enhanced design principles which had emerged from the first iteration were tested and further refined. The results of the iterations were reported in the chapter on the data analysis and are discussed further in the next sections.

Chapter 5 discussed the research findings from the two iterations and elaborated on the project artistry journey which had been undertaken by the participants in the educational technology sandpit, the practical application of the design principles which were expanded upon in Chapter 3, and how they were enhanced through this first iteration. These new enhanced principles were then used in the multidisciplinary sandpit where the emphasis was on the use of tools to reinforce some of the points highlighted in the enhanced principles. The final outcome was the new enhanced design principles that were used to inform the project artistry framework. This was discussed at length in Chapter 6.

Chapter 6 contained an in-depth discussion, using some of Klein and Myers's (1999) seven principles of interpretive research but specifically for the purpose of analysing processes so as to revisit the original conception of project artistry via the twenty-six different conceptions. The data collected was analysed in order to highlight the alignment of these constructs with the themes that emerged from the iterations. Other prominent emerging themes were then used to reconstruct ABC of project artistry. Figure 50 provides a graphical depiction of this. This involved investigating the individual parts; the stages of the project artistry process, the experimentation in real life scenarios and delving into the meaning using the hermeneutic circle principle, it then became necessary to think about the whole by rethinking of the project artistry model. Figure 53 depicts this new model in terms of which the design process is represented as a house which four pillars, and seven foundational bricks which had emerged from the core themes during the data analysis. In view of the fact that essentially the main research question was grounded in projects that are highly ambiguous, it was also deemed important to propose an ambiguity journey (see Figure 51) that guides project teams in the face of ambiguity. The last section discussed both the issue of creative confidence (Figure 54) at an individual level and group level as well as feedback about the process. It was interesting to note the comments that referred to fun, enjoyment and play, which are core to the sandpit concepts.

In this chapter, I start by discussing the research clarification journey I had undertaken, including the research sub questions which emerged from the journey. In section 6.2, I explain how these questions were answered in the study. Section 6.3 extrapolated on the findings and the resulting enhanced

design principles as well as how these enhanced design principles informed the project artistry framework. The last two sections deal with the contribution of the study, my personal learnings and, finally, proposed future research which may be built on this study.

## 7.2 Original research questions

I posed the following research project at the start of this study, namely, *how may projects characterised by high levels of uncertainty and ambiguity be managed?*

The following critical question emerged from this question during the literature review:

*“What is the role of the project classification school of thought in project contextualisation?”*

In this study, I attempted to make a case for the classification of projects, arguing that the “one size fits all approach” to project management is both misleading and disadvantages project managers in the real-world context which is characterised by high levels of change and uncertainty. In addition, the mechanistic, linear, simplistic approach to projects stifles the creativity and potential in projects to generate novelty and ensure lasting relevance. I deemed it necessary to first recognise the complexity of the project as well as the level of ambiguity and uncertainty regarding project objectives and skills and then to choose a non-conventional entry into such project such as was proposed in this thesis.

The school of project classification, which is proposed by a number of writers (Aucoin, 2007; Lenfle, 2013; Obeng, 1994; Turner & Cochrane, 1993) plays an important role in decisions made regarding the context of the project and the use of various methodologies or approaches to managing the project.

However, I wish to urge project managers to go further and to approach every project with this mind-set. This upfront approach will enable project managers to let go of assumptions, status quo, face value and superficial facts about projects and to delve more deeply into previously unknown information that may result in redefining the project vision and direction to allow greater impact and novelty than



may otherwise have been the case.

This led me to study the existing project management body of knowledge and to look for existing project management phenomena that I could use to answer the research question. According to the school of project classification projects may be classified into different categories. This thesis focused on the category of highly complex projects, referred to in this study as “exploration” projects. This type of projects starts at a point where both the project objectives and skills are unknown (see Figure 1). In chapter 6, I discussed an ambiguity journey in such projects (Figure 51). Such a journey allows project teams to acknowledge that the operational environment of such projects is both volatile and highly uncertain and, hence, ambiguity tolerance is permitted while team members are encouraged to remain in state of curiosity, questioning and openness to “what might be” rather than “what is” in order to bring about innovation and novelty in such projects.

### 7.2.2 Research sub-questions

During further research into the project management body of knowledge, I discovered that there are gaps in the existing literature as regards guidance in respect of the leadership and implementation of these projects. This led to the formulation of a more refined, specific research question “*How to facilitate an enabling project environment that stimulates creativity and encourages co-creation in exploration projects?*”

This became the overarching research question, which was then broken down into the following two sub questions during the literature review process, namely:

1. *What are the design thinking and creative problem-solving principles that may enrich the process of vision creation and conceptualisation in exploration projects?*
2. *How may the emerging design principles be enhanced through experiments to ensure a more practical framework for managing exploration projects?*

The next section discusses how I went about addressing these sub questions

#### 7.2.2.1 First research sub-question

*What are the design thinking and creative problem-solving principles that can enrich the process of vision creation and conceptualisation of exploration projects?*

I conducted an exploratory study of existing literature on design thinking and creative problem solving and extracted the design principles that informed this study. A project artistry framework, which may be used to guide the facilitation of exploration projects, emerged. Chapter 3 elaborates on the development of this framework.

#### 7.2.2.2 Second research sub-question

The second research sub-question was more practical than the first and application within a specific context was required in order to address this sub-question.

*How may the emerging design principles be enhanced through experiments to ensure a more practical framework for managing exploration projects?*

I chose the education field as a suitable platform on which to test the proposed methodology of project artistry. Chapter 2 includes a justification for this choice. Practical, authentic, natural settings were selected for the purposes of the study to provide answers to this research question. The projects undertaken in the educational sandpits demonstrated the characteristics of exploration projects as addressed in this thesis as these projects innovative projects which are carried out by diverse teams in order to achieve an unknown purpose. I used DBR (Chapter 4) which stipulates that the researcher must work closely with practitioners to identify problems and devise design solutions. I proposed the project artistry framework as a possible design process to guide project development in the educational sandpit context. There were two iterations: one in the educational technology sandpit and

one in the multidisciplinary sandpit.

After the two iterations (Chapter 5), the original design principles which had emerged from the literature review (Chapter 2) were enhanced as a result of these iterations. The enhanced project artistry design principles which emerged are presented in Table 20 below.

Table 16: Enhanced Project artistry design principles

Enhanced project artistry design principles from the second iteration
<p>Ensure the diversity of the team within the context of the projects being developed.</p> <p><i>Then use either surveys or questionnaires to acquire information about the participants that will help in understanding their mentality and personality types prior to engagement and programme development.</i></p>
<p>Spend sufficient time thinking about the exercises and activities that will empower the participants and increase their creative confidence and then to embrace each other's creativity and perspectives.</p> <p><i>This may require the practical use of artistic activities.</i></p>
<p>Identify high-priority socio-cultural issues and develop exercise to create cultural dexterity.</p> <p><i>Once there is an awareness of any possible socio-cultural issues (data collected in accordance with principle 1), identify high priority issues and develop exercises that attempt to combat the effects of some of any socio-cultural issues in order to create a healthy thinking space and help the participants to relax into the space. In certain contexts, it may be necessary to provide a high-level overview of the programme, to help the participant to relax and in other instances, to create a sense of excitement about what may emerge from the ambiguity.</i></p>
<p>Use the language of creativity to help the participants to remain in the "questioning" mode rather than the solution mode.</p> <p><i>It is perhaps important, from the beginning of the programme, to socialise the group in the language of creativity and to keep using the (How might we, In what ways might we, How to) questions during the contextualisation phase.</i></p>

Ensure reflection, both individually and/or in groups to ensure learning from those activities about judgement to create deep learnings.

*In as much as exercises that encourage fun, laughter, and play are built into the programme.*

Understand the context, push the boundaries and allow the participants to go to extremes to ensure as real an experience as possible of the artefact.

Use tools such as the Pluses, Potential, Concerns and Overcome Concerns (PPCO) tools to reinforce a positive atmosphere for feedback. Do not assume that, because there is positive energy in the room and excitement, the feedback will also be positive.

Integrate time-bound exercises, activities, tools that allow thoughtful converging and diverging during the different stages. It may not be necessary to socialise the participants into the jargon if it is inherent within a programme.

Do not under estimate the power of imagination. Find the balance between being analytical and intuitive and exploiting and exploring to ensure that the participant remain imaginative but also seriously realistic.

Socialise the team into the language of creativity throughout the process.

Allow moments of reflection. This may also be done through tools such as brain writing and talking stick. These tools may be integrated in the programme design.

The project artistry design principles listed above and the outcome of the first iteration were used to rethink the ABC of project artistry explained in the discussion chapter. This led to further rethinking the project artistry framework (Figure 53) with more detailed pillars and seven foundational bricks emerging from the analysis of the data.

### 7.3 Reliability and validity of the study

#### 7.3.1 The Trustworthiness of the study

The interpretivist table (Table 1 in Chapter 1) demonstrates that according to the interpretive paradigm, human beings construct meanings in unique ways, depending on their context and personal

frames of reference as they engage with the world they are interpreting (Crotty, 1998). This is the notion of multiple constructed realities (Crotty, 1996). In interpretive research, the findings emerge from the interactions between the researcher and the participants as the research progresses (Creswell, 1998).

Thus, in this type of research subjectivity is valued and it acknowledged that human beings are incapable of total objectivity because they are situated in a reality which is constructed by subjective experiences. Furthermore, this type of research is value-bound by the nature of the questions asked, the values held by the researcher and the ways in which the findings are generated and interpreted.

In choosing a particular paradigm, certain assumptions and perspectives are accepted. The interpretive paradigm was deemed to be the most suitable for the purposes of this research study because of the study's potential to generate new understandings of complex, multidimensional human phenomena, such as those investigated in this research (creativity, co-creation and collaboration in project management). Specifically, this study sought practical knowledge which is embedded in the world of meanings and of human interactions. It was therefore appropriate to investigate this phenomenon within the interpretive paradigm.

Establishing the trustworthiness of a qualitative research design is essential as regards its relevance and viability for future research. As such, the qualitative researcher is compelled to "demonstrate that the methods used are reproducible and consistent, that the approach and procedures used were appropriate for the context and can be documented, and that external evidence can be used to test conclusions" (Ary et al., 2006, p. 509). In controlling the trustworthiness of qualitative studies, researchers must consider the data collection, analysis and interpretation methods used (Guba, 1981).

In an effort to address some of the criticism levelled at qualitative studies, numerous researchers have searched for methods with which to assess the rigour of the data collection and data analysis. Lincoln and Guba (1985) published the following three imperatives required of researchers:

- 1) Present sufficient detail regarding participants to enable readers to formulate judgements concerning findings of the study

- 2) practise assiduous data collection and data analysis methods
- 3) apply methods such as triangulation, audits and reflexive journaling to demonstrate the consistency of the data (p. 305).

Trustworthiness implies procedures that assess the degree to which the examination accurately represents the observations of the participants: whether other researchers would reach similar conclusions based on the data; whether the analysis procedure is sufficiently flexible to account for variations in experiences; and the degree to which the study elements were sufficiently described to allow for comparison with other populations and study findings. Various frameworks have been developed to evaluate rigour or to assess the trustworthiness of qualitative data (Lincoln & Guba, 1985).

I followed the guidelines of Lincoln and Guba (1985) to enhance the trustworthiness of this study. They contended that the trustworthiness of a qualitative study incorporates the following four elements, namely, credibility, transferability, dependability and confirmability.

### **Credibility**

The credibility of the study was ensured by engaging the practitioners, participants and peers in the reviews of the findings. By nature, DBR encourages consistent engagements and feedback. The participants were given the interview transcripts and the research report to provide them with an opportunity of either confirming or refuting the findings. Patton (1990) asserted that the credentials and experiences of the researcher enhance the credibility of a qualitative study.

### **Transferability**

According to Merriam (1998), the transferability of a study refers to the degree to which findings of one study may be applied to other situations. Ary et al. (2006) maintained that transferability is “the degree to which the findings of a qualitative study can be applied or generalised to other contexts or to

other groups” (p. 507). Lincoln and Guba (1985) indicated that the utmost significant attribute of transferability is the commitment of the researcher to articulating the circumstances or events that model the setting within which the phenomenon occurred, thus presenting contextual material for the reader to transfer results. The transferability of the findings of this study was enhanced by the thick, rich data that was collected during the interviews, observations and document collection.

### **Dependability**

Dependability represents the prospect of reproducing the research with the same framework, methods and participants, and achieving the same results (Creswell, 1997). Lincoln and Guba (1985) reasoned that by establishing the credibility, dependability of a research study is more assured. In order to ensure the dependability of this research study, I provided an extensive and detailed explanation of the methods used in the study. This explanation a comprehensible account of the research conducted.

### **Confirmability**

Confirmability in qualitative research corroborates that the findings of the study are the outcome of the experience and ideas of the participants in the study, and not of the researcher (Merriam, 1998). The study does not represent on the researcher’s views but the exchanges and rich discussions during the real-life contexts where the iterations took place.

#### **7.3.2 Limitations of the study**

As with all other studies there were some potential limitations to the study, including the following.

1. A voluminous amount of information was collected while all the available literature constitutes a tremendous challenge for those who wish to remain up to date in their understanding of the literature. This is a qualitative study and this, in itself, may be seen as a limitation in academic circles. In the academic circles in the United States, research

contributions that do not include quantifiable verification are often less valued as compared to others (Gherardi & Turner, 2002).

2. Although the findings of the study may ne generalised, this should not happen. Many of the interpretations made were based on the personal experiences of specific participants and this makes the transferability of the findings difficult. However, to generalise was never the intention of the study. This qualitative study was undertaken with the aim of creating new meaning and reaching a nuanced understanding of project team expectations.
3. This research project had an interpretative character and was aimed at discovering the meaning of certain events for specific individuals. The fact that these experiences were interpreted by myself (as the researcher) may raise a question regarding objectivity.
4. A further limitation is the lack of focus on the differences in the individual characteristics and personalities of the participants, for example, their team roles, cognitive styles etc.
5. Lastly, I do not claim to have identified all the possible and relevant themes regarding the expectations of teamwork. However, the data I gathered (interview transcripts) are saved on CD and may be used by future researchers seeking possible alternative interpretations and research initiatives.

## 7.4 Contribution of the thesis

This section identified seven areas to which the outcome of this study may contribute.

### 7.4.1 Project management body of knowledge

In Chapter 2, I elaborated on the gap in PMBOK as regards managing highly ambiguous projects in the world in which we live. I used the project classification school of thought to emphasise that the “one-size-fits” approach to project management is detrimental to the experience of practitioners while it



further perpetuates the positivism construct that builds a wider bridge between theory and practice than should be the case. Hence, in this work I propose the following:

- a. Firstly that, in line with other writers (Aucoin, 2007; Lenfle, 2013; Obeng, 1994; Turner & Cochrane, 1993), projects should be classified according to the clarity of the research objectives and enablers (see matrix proposed in Figure 1). Different approaches should then be theorised for each category of projects.
- b. This thesis focused on the highly ambiguous projects, which do have either clear objectives or clear enablers. These types of project are referred as exploration projects in this thesis. The aim of this study was to use the well-defined design principles from design thinking and creative problem solving in order to build a framework for designing such projects. The study also explored the emergence of project artistry, which was first proposed by Duggal (2012), so as to draw from other schools of thoughts as well. This enabled the researcher to build a project artistry framework which specified an entry into the process, the design process and the exit from the process. Based on the two iterations, seven foundational bricks and four pillars emerged that ensured both the results and effectiveness of the framework.
- c. Lastly, it is essential that project managers cultivate both a culture and mind-set of experimentation so as to enable them to become facilitators rather than just the managers of exploration projects.

#### 7.4.2 Educational sandpits

Chapter 3 defined the educational sandpit concept that had emerged in the new millennium to address wicked problems in the education field, specifically the problems of contextualisation, relevance and empowerment through problem solving and innovative approaches on the part of educators. On the basis of the fact that I was able to identify similarities between exploration projects and sandpit

projects I decided that educational sandpits would be an appropriate environment in which to test this thesis.

The information below may be used in the education field to design educational project concepts that are both contextually relevant and provide a culture of problem solving and creativity in groups in such a way so as to embrace diversity and ideation. This work may be useful in a number of areas identified in these areas:

- i. The concept of educational sandpit is appropriate in creating an atmosphere of play, collaboration, co-creation and the emergence of innovative solutions to wicked problems in education. However, to date relatively little research has been done conducted within this context of educational sandpits on the design processes, the atmosphere and the facilitation required in order to create an enabling environment for innovation. The refined design principles which emerged from this study may be used to guide the facilitation of educational sandpits.
- ii. As noted in Chapter 2, although currently technology is playing a major role in education its potential has not yet been fully explored in the African context nor has it been re-imagined to accommodate this unique context. Hence, specifically in terms of the notion of educational technology sandpits, the contribution of this thesis has been invaluable in, firstly, developing a culture of problem solving and imagination in educators, secondly, in formulating design principles that may guide the development of contextually relevant solutions to day-to-day and long-term problems and, thirdly, in facilitating the spirit of experimentation and prototyping that results in greater clarity as regards the objectives and conceptualisation of educational projects and that leads to new innovative solutions that are locally developed but may also be explored in other contexts. Finally, the process emphasises the importance of empowerment and creative

confidence that, if facilitated properly, may lead to a change in mind-set and fresh, new approaches to problem solving.

- iii. The concept of multidisciplinary is gaining popularity in education. The silos that are dominant in academic research and academic institutions are being challenged by the new world of connectivity and complexity in which problems comprise multiple, interrelated parts that impact on several different disciplines (see Chapter 3). There is a growing demand for the facilitation of multidisciplinary groups to generate a common vision and projects while, at the same time, embracing multiple perspectives and diverse input through the practical design principles were developed and enhanced in this thesis.

#### 7.4.3 Design-based research in education

There is a growing community which is using DBR in education. This methodology is being used primarily to test the learning designs and technology deployments in education. This study used DBR to test a design process and to improve a process that may be adopted by educators. This application may be said to be unique as a phenomenon which had been developed in another body of knowledge, namely, project artistry, was tested and improved in the education field as a process with the potential to bring about a new mind-set and culture of innovation. The application was specific to the process rather than being a pedagogical or learning innovation. This undertaking presented its unique application challenges. The iterations had to be carried out in an authentic learning environment with the participants not being made aware of the underlying research and observations taking place. In addition, I had to act as both the facilitator and the observer. This gave me the power to design, re-design and adjust as I saw fit during the process.

A considerable volume of data was captured through videos, interviews, polls, surveys and reflections. The sense making process was extremely intense as a result of the required awareness on the part of

the researcher of the reality as it unfolded, my own notes and reconciling the findings with the feedback from the participants, practitioners and experts in the field. The ongoing interaction with the participants and the power to redesign some parts of the programme were invaluable as this enabled real life interventions and modifications to the process as I saw fit. However, this did have both negative and positive effects. It was essential that I maintained an extremely high level of alertness during the observations and the facilitation. Engaging the practitioner throughout the process and holding numerous several conversations about the observations and ongoing reflections on a daily basis were key to the study. Without this level of engagement with the practitioner, it may become challenging to both facilitate and conduct research as the level of control and power may result in the researcher promoting his/her own subjective views rather than recording and redesigning based on the authentic experiences of the participants. This method is still in its embryonic stages in the African context although it proved to plausible in testing and enhancing design principles in authentic settings.

#### **7.4.4 Pedagogical contribution of this thesis**

Although the aim of this thesis was to develop a process, test it in a real life setting and improve it based on the findings, the fact that it was tested in the education field implied a level of pedagogical input observed from the work. At the time of the study the practitioner worked in the education department at the University of Cape Town. The participants were all educators and researchers and their feedback reflected the ways in which they had found the workshops to be beneficial to their teaching and engagement with students. This led to a discussion of how they could use some of the tools to unleash their students' creativity in their teaching assignments.

#### **7.4.5 Design thinking in the management discourse**

Chapter 2 discussed the emergence of design thinking and how its roots were in the design discourse. However early in the millennium design thinking began to emerge in the management field as a methodology that could be adopted by businesses to address the wicked problems encountered in

both business and management. Since then design thinking has developed into a management phenomenon which has been embraced by numerous organisations to drive innovation and competitive advantage through customer centric approaches, co-creation and an iterative design process. The contribution of this study to this body of knowledge are the principles developed during the study from integrating the design thinking and creative problem-solving principles with existing project management principles and which resulted in project artistry. This, then evolved into systematic way of facilitating exploration projects using the best of the three worlds of design thinking, creative problem solving and project management body of knowledge.

#### **7.4.6 Multidisciplinary teams in the African context**

The empirical research in both interventions involved diverse, multidisciplinary, multicultural teams from different African countries. Although they all had one thing in common, namely, that they were in the education field, both groups represented people from over fifteen countries in Africa and from varying academic, social, cultural, and geographical backgrounds. This ensured that the outcome of this study was relevant to the facilitation of diverse teams from anywhere on the African continent. The output and comments from both groups revealed certain few design principles that are relevant to the African context, including the following:

##### **7.4.6.1 Socio-cultural background and thinking spaces**

There are numerous factors that influence individuals in teams in their relating to one another. These include socio-cultural factors that may create prejudices and biases as regards education levels, economic status, gender, race, etc. These may affect the way in which people relate to each other, respect each other and receive each other. They may be extremely detrimental to creative thinking spaces as there is the risk that some people may be either advantaged or disadvantaged advantage on the grounds of rank or social or cultural status.

For example, in pre-1994 South Africa the apartheid regime was in power for some time. Fundamental to this regime was the “principle” that whites are superior to blacks. Those who lived under this regime and grew up in this time have, as part of their psychological make up, the notion that intellectual supremacy is based on the skin colour, and they often struggle to accept the notion of creative spaces that embrace all participants as thinking equals. Such a belief would perpetuate a lack of equal contribution from all participants in creative teams.

Other examples may include participants being advantaged as a result of their economic standing, social standing, gender, education etc. This type of prejudice is often one of the most detrimental factors in brainstorming and creative thinking spaces of which the essential characteristic to seeking diversity, drawing from the strength of different perspectives, harnessing the power of each individual mind and experience in the room in order to allow whole new solutions to wicked problems to emerge.

Based on the findings of this work I propose it is essential that the project facilitator is aware of the group profile in terms of the above factors and of the possible impact of such factors on the group. It is, thus, incumbent on the facilitator to devise ways of abolishing these prejudices and biases through exercises, activities or presentations before the group begins to interact.

The “Picasso”<sup>8</sup> used in the multidisciplinary sandpit is an example of such an exercise that immediately addresses the embedded socio-cultural factor of educational achievements and titles that may give other advantage based on their qualifications.

There is no shortcut but overlooking this important factor may result in both limited ideas and the abandonment to intellectual input by the disadvantaged participants.

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<sup>8</sup> Exercise of drawing each other’s faces without looking at the canvas

#### 7.4.6.2 Creative confidence

Many people do not believe they are creative. According to research, creativity diminished with age from 98% at five years old to 2% at forty years old (Thompson, 2010). Nevertheless, it is believed that creativity is key to innovation and novelty in projects. Thus, when diverse teams are brought together to engage, explore and embrace individual creativity in order to collectively conceive and co-create a project, creative confidence is a key ingredient to the success of such a project. This is twofold. The individual team members need to each possess a level of confidence as regards their belief in what they are capable of and, also, a belief and a trust in one another's creative power. The facilitator of such a team must ensure an environment that nurtures this behaviour.

#### 7.5 Personal learning

In closing, I wish to share my personal learning from this study. It started as a personal inquiry emerging from my discomfort with the lack of alignment between the theory and practice in project management. This study emerged from my background in project management and also the observation and experience that, although project management education is gaining in popularity and there is much being published within this field, yet, increasingly projects are failing while the literature is not reflecting the complex operating environment of project management with many of the texts alluding to project management as a practice of planning, coordinating and managing resources. However, the reality is that project managers are alienated by the perfectionism and theoretical rationality portrayed by the traditional project management tools and frameworks.

Project managers are finding themselves improvising, changing original plans, creating, communicating, facilitating atmospheres of productivity, and developing increasing trust and confidence instead of rigour and coordination. The dichotomy between practice and theory in project management led me into this journey as did my ensuing exposure from exploring the project management body of knowledge, seeing the multiple perspectives and criticisms of the positivist

approach and numerous emerging approaches that are supposedly both plausible and relevant but lack coherence. In some instances, the tools and frameworks perpetuate the same positivistic approaches.

Through this research journey I realised that there is a more plausible approach to project management than the traditional one. The journey starts with an acceptance of the realities of the various types of projects that are conceived and implemented in a world that characterised by high levels of complexity, ambiguity and uncertainties in a fast-changing environment. These realities sometime emerge amid the implementing, deploying or even testing. The informed manager is aware that it is essential to reiterate and revisit objectives, redefine and redirect the team as regards the new realities emerging from the changed environment.

Secondly, once the reality of a project that may start without clear objectives and the means to achieve those objectives has been accepted, the project manager must be empowered with the skills required to navigate that space of uncertainty. This study proposed that the design principles of project artistry may inform project managers how to facilitate a process of project conceptualisation where objectives and means emerge through a guided process and from diverse teams, thus creating a common vision and new, unique projects.

Thirdly, the application of project artistry in the educational sandpits in the empirical study which was conducted in both cases opened my world to the sandpit concept, This concept appealed to me as an intriguing and dynamic concept and certainly one applicable outside of the education field. I propose that various organisations, industries, disciplines and areas are in need of a new thinking and new mind-sets that embrace uncertainty and ambiguity as a way of exploring new opportunities and creating innovative approaches to businesses.

Fourthly, the emergence of the design principles of project artistry and their refinement through the experiences opened up a window of opportunity to apply the very methodology proposed in this thesis, namely, exploring the phenomenon of combining the known principles of design thinking and



creative problem solving and applying these combined principles to the project management body of knowledge. I envisaged the rapid development of a prototype, in this case project artistry, and then testing the prototype in a real-life setting in order to improve and develop a more refined version through experience and feedback. Although the resulting design principles may not be perfect they have been tested through a rigorous research process and may be used as guidelines for exploration projects.

Lastly, I learned that design thinking, although highly recommended in the management field and despite its increase in popularity in the African context, it is yet to be contextualised and defined and requires further empirical evidence in this context. It is in this light that I propose further research – see next section.

## 7.6 Concluding remarks and possibilities for future research

Although this was not a perfect study, the natural settings in which it was tested, the authenticity of the environment and the feedback received from the interviews all enhance the authenticity of the study. I accept that, as a researcher, a facilitator of the workshops and the curator of this story, my own biases and prejudices may have influenced the interpretations in the study. However, I made a concerted effort to allow the themes which emerged from the feedback obtained in an authentic setting to inform the study. In addition, I adopted a design approach which made possible the freedom to change and influence the workshops as I saw fit. However, this was all done in collaboration with the practitioners in the field in the case of the ETILAB, and with other facilitators in the case of the ASLP. The approach used in this research project is the very approach recommended in the study to ensure a more innovative, creative and versatile approach.

In view of the fact this was an exploratory study of a new phenomenon, it is recommended that more empirical studies and explorations of project artistry be conducted to strengthen, challenge, build on and/or review this study. Based on the discussions in the previous sections, I would propose the following areas as possible follow up work based on the findings of this study.

1. Additional DBR empirical studies to further refine and enhance the principles which emerged from this thesis with possible application in contexts other than education and analysing the differences between industries, contexts, organisations, fields etc. in order to develop a more refined project artistry phenomenon.
2. Additional research on and more specific insights into the application of project artistry where the ambiguity is limited not only to methods or objectives but also to unknown factors.
3. The application of the concept of a sandpit to other industries and guided by these design principles, possible differences and the impact on innovation on such industries and on the culture in organisations.
4. More deliberate research into the socio-cultural factors that affect creativity in multidisciplinary teams in the African context.

It may be concluded that the principles of design thinking and creativity problem solving may be applied to improve the project management of exploration projects. The design principles explored in this thesis may enhance both project delivery and the execution of educational sandpit projects.

*Project Artistry*  
*Bringing the artist back into project management,*  
*Unleashing the potential within,*  
*Uncovering the hidden man,*  
*Reenergising the artist within,*  
*Revitalising the innate creativity of man and*  
*Bringing the magic of creation back to the world!*

■ *Puleng Makhoalibe*

## 8. References

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## 9. Appendices

### Appendix 1: Details and programme for the ETILAB participants



EDN4502W: Research & Evaluation of Emerging Technologies in Education

#### Overview:

This module is premised on an understanding that emerging technologies (ET) are not yet fully researched and both theories and methodologies for researching ET in education are still evolving. In Africa, the mobile devices, in particular mobile phones have diffused in societies and become an indispensable everyday tool. However, though only a few effective pedagogical uses of mobile phones are reported in literature, there is a yearning gap for researchers in the mobile learning landscape. Thus, this module seeks to occupy this unique niche. To this end, the objective of this module is to empower participants with both conceptual and practical understanding of how to propose, design, research and evaluate mobile learning in resource constrained environments. The module is structured around the following five interrelated constructs: context; design-based research; design thinking; mobile learning frameworks; and evaluation.

#### At the end of the course, participants will be able to:

- Conceptualise the role of context and socio-cultural settings in shaping use of mobile technologies
- Design and implement a mobile learning intervention
- Conceptualise innovative mobile learning designs
- Theorise mobile learning
- Evaluate mobile learning projects/interventions
- Research and write a rigorous academic /reflective essay and present at a research seminar.

#### Themes:

The course is structured around the following inter-related themes:

- Design-Based Research (DBR)
- Design Thinking Principles
- Mobile learning theories and frameworks
- Development of a mobile application and researching it

## Appendix 2: ETILAB Participants' profiles

Title	Gender	Population group	Citizenship
Mr	Male	NA/Unknown	(UGA : Perm Res)
Mr	Male	NA/Unknown	(ZMB : Citizen)
Miss	Female	NA/Unknown	(ZWE : Citizen)
Mrs	Female	White	SA Citizen
Mr	Male	Indian	SA Citizen
Mr	Male	NA/Unknown	(UGA : Citizen)
Mr	Male	NA/Unknown	(UGA : Citizen)
Mr	Male	NA/Unknown	SA Citizen
Mr	Male	NA/Unknown	(UGA : Citizen)
Dr	Female	NA/Unknown	(UGA : Citizen)
Mr	Male	White	SA Citizen
Mr	Male	Coloured	SA Citizen
Dr	Female	NA/Unknown	(UGA : Citizen)
Mrs	Female	White	SA Citizen
Mrs	Female	Indian	SA Citizen

Mr	Male	Coloured	SA Citizen
Ms	Female	NA/Unknown	(UGA : Perm Res)

## Appendix 3: Programme: For the ETILAB Sandpit Programme

### Research and Evaluation of Emerging Technologies Module

**Dates:**  
**1-6 September 2014**  
**Venues:**

Seminar Room 6A  
6<sup>th</sup> Floor, Hoerikwaggo Building, North Lane, UCT

<b>Monday 1 Sept</b>			
<b>Start</b>	<b>End</b>		<b>Notes</b>
09h00	09h30	Welcome and Introductions	
09h30	10h30	Session #1:	
10h30	10h45	B r e a k	
10h45	12h00	Group activity #1	
12h00	13h00	Session #1: Mobile learning landscape	CB
13h00	14h00	L u n c h	
14h00	15h00	Session #2: FRAME	
SS			
15h00	15h15	Break	
15h15	16h15	Session #3: Design thinking	PM
16h15	16h30	Recap of day 1 Reflection: Preview of day 2	

<b>Tuesday 2 September</b>			
<b>Start</b>	<b>End</b>		<b>Notes</b>
09h00	10h00	Review of day 1	
10h00	11h30	DBR	Amory
11h30	11h45	B r e a k	
11h45	13h00	Session #4: Design Thinking	
13h00	14h00	L u n c h	
14h00	15h00	Session #6:	
SS			
15h00	15h15	Recap of day 2 Preview of day 3	

15h15	15h30	B r e a k	
15h30	16h00		

**Wednesday 3 September**

Start	End		Notes
09h00	10h30	Jan Herrington -	
10h30	10h45	B r e a k	
10h45 LS	13h00	Workshop #1:	
13h00	14h00	L u n c h	
14h00	15h00	Session #8: Design Thinking	
SS			
15h00	15h15	Discussion #5	
15h15	15h30	B r e a k	
15h30	16h00		
16h00	16h30	Recap of day 3 Preview of day 4	

**Thursday 4 September (pm to work on presentation)**

Start	End		Notes
09h00	09h30	Review of day 3	
09h30 SS	10h30	Gro	
10h30	10h45	B r e a k	
10h45 SS	12h00	Session #10: Design Thinking	
12h00	13h00	Group Activity #3: Design Thinking	
13h00	13h30	L u n c h	
13h30	15h15	Group Activity #3 Design Thinking	
15h15	15h30	B r e a k	
15h30	16h00	Recap of day 4 Preview of day 5	

**Friday 5 September (Group presentations)**

Start	End		Notes
		Session #11: Design Thinking	
09h00	16h00		

**Saturday 23 March 2013 (individual presentations)**

Start	End		Notes
09h00	10h30	Student presentations	
10h30	10h45	B r e a k	
10h45	12h30	Student presentations	
12h30	13h00	Reflections Evaluation Class photo	



## Appendix 4: Summary of the ETILAB design process constructed from the project artistry framework

### **E**mpathise – Project contextualisation

*“Empathy is the centrepiece of a human-centered design process” (Kelly, 2008).*

The concept of the ETILAB emerged from the place of empathy with educators who often feel pressurised to use technology in their teaching despite the lack of sufficient investment in empowering them to use the technology and ensuring that they are confident in their use of the tools.

These educators often find themselves in a difficult space in which they are competent in their disciplines but not equally confident in the technology tools to support their pedagogy. Some of the major obstacles to using technology include fear as well as a reluctance to make mistakes and look like “an idiot” in front of the participants when using technology. This fear is often expressed in forums where they come together and talk openly about their experiences.

The ETILAB was designed for the educators as a safe space in which experiment, play and to co-create with others. Each artefact comes from the place of empathy, identifying with the users, understanding them deeply and feeling their pain.

### **T**hink – Project contextualisation

*“Problems are half-solved if properly stated” (Mark Twain)*

People often do not think about problems deeply, seeking to identify the root of such problems. They are naturally inclined to move into the solutions space before clearly understanding the problem. Dissecting a problem that the user faces with the user, identifying the root causes of the problem, the symptoms and other related components and connections enables the user to define the actual problem and define it much more clearly deliberately than may otherwise have been the case. This is a critical step

towards solving the problem.

The aim is to get to the root of the problem through questioning, observations, listening, engagement as the individual concerned seeks both to understand the world from another person's perspective and to frame the problem in a way that reflects thorough understanding.

The outcome of this stage is a clear problem statement that provides focus and reframes the problem into a refined challenge that invites solution and stimulates new thinking.

## **I**deate – Project ideation

***“The best way to have a good idea is to have lots of ideas” (Linus Pauling).***

Once the problem has been clearly defined in the above step, it becomes necessary to brainstorm ideas on how to address or solve the stated problem. This step provides users and providers with the ability to diverge on every possible solution with the aim of eventually converging to a more feasible, desirable and viable solution. The ideation phase is critical in facilitating the exploration of possible solutions and allowing varying ideas, building on another's idea and seeking wild and “crazy” ideas with the purpose of generating innovative solutions.

The outcome of this phase is a list of ideas or an idea that addresses the challenge that has been identified.

## **L**earn – Project development

***“Through learning we re-create ourselves. Through learning we become able to do something we never were able to do” (Peter Senge).***

This is critical in the development of technology projects as the world of technology is volatile and, thus, it changes continuously. It is important to ensure that there is willingness and eagerness to brainstorm and to learn new technologies, new languages, new ways of thinking and

new processes that facilitate innovation. In addition, learning about the problem as formulated in the previous steps and learning about the various solutions proposed are key to the successful delivery of projects. A culture of learning is stimulated through openness and embraces the ethos of experiential learning in an environment in which it is safe to make mistakes, learn from them and expand existing knowledge boundaries.

## **A**ct – Project conceptualisation

***Creativity requires the courage to let go of certainties” (Erich Fromm).***

It takes courage to act on the decisions made during the previous steps. The ETILAB is a space of action, where things happen and thoughts are transformed into reality. It is a space that espouses the view that there is a homegrown solution to education challenges to be uncovered and that the first step in this process of innovativeness is to act. Thus, the co-creation that is at the heart of design thinking, the ability for a team to make decisions (i.e. act) and then perform the tasks necessary to make the artefact a reality, are all vital.

This project conceptualisation step requires the boldness to develop the idea into an artefact/a prototype that may be tested

## **B**uild – Project conceptualisation

***“Build the bridge as you walk on it” (Bob Quinn).***

The final step in the process is that of building. In the ETILAB, the ethos is often to “build the bridge as you walk on it”. This does not require a full specification, architectural plans and fully fleshed building plans before the actual work may start but, it, instead, it requires, building, talking to the client, obtaining feedback, modifying according to the feedback and a willingness to destroy and rebuild when necessary.

In short, this step requires building on the prototype in order develop a fully functional solution.

## Appendix 5: Projects from the ETILAB participants

	Problem to be Solved	Solution provided	Educational APP details	Functionality of the APP	Key principle learned
1	<ul style="list-style-type: none"> <li>- Extremely large classes</li> <li>- Difficult to track how the participants are doing in large classes -- assessment</li> </ul>	<ul style="list-style-type: none"> <li>- Tracker to alert lecturers on participants who are struggling and to facilitate a platform from which the lecturers and participants are able to communicate on their struggles decide on remedial work.</li> </ul>	<p>Name of the APP: <b>Edutrack</b></p> <p><b>Description:</b> Educational tracker with mark tracker, calendar, chats, social walls, blogs, contacts and podcasts</p> <p><b>Main functions:</b></p> <ol style="list-style-type: none"> <li>1. Alerts lecturers to the participants who are below average</li> <li>2. Facilitates chats with the whole group</li> <li>3. Facilitates private contact with participants</li> </ol>	<ul style="list-style-type: none"> <li>- Functionality to assess the participants who should be included.</li> <li>- Icons should be visually appealing</li> <li>- App is for the lecturer not the participants</li> <li>- Does not address the integration between the student and the lecturer</li> <li>- Obtaining feedback from the participants within a short time is critical</li> <li>- Access to tracker only by lecturer</li> <li>- The app should address lecturers not providing participants with feedback on time</li> </ul>	<ul style="list-style-type: none"> <li>- In a creative process, it is important to re-enforce a positive atmosphere, even if the result is still not good enough.</li> <li>- The process of co-creation must enable an atmosphere in which a client feels as much responsible as the provider for the prototype.</li> <li>- The demonstration of the prototype may trigger other ideas that did not initially exist. This is perfectly acceptable in a co-creation process.</li> </ul>
2	<p>It was difficult to engage the participants in the content and learning enforced in traditional ways.</p> <p>The solution had to be "cool".</p>	<p>Develop content in such a way that a participant wants to interact with it and is excited about learning.</p> <p>One subject app, namely, biology</p>	<p><b>Name of the APP:</b> <i>sCoolApp</i></p> <p><b>Description:</b> Biology app that allowed interactive, graphical content specific app presenting material in ways that encouraged the participants to want to learn.</p> <p><b>Functions:</b> Chats, video content, social, news, calendar, twitter and Facebook etc. Surprise and wow feature: QR Quotes.</p>	<ul style="list-style-type: none"> <li>- The app is VERY cool and exceeded the expectation of the clients.</li> <li>-The clients loved the look and feel of the app and were happy with the functionality.</li> <li>- The clients asked for notifications if the participants were not in the APP.</li> </ul>	<ul style="list-style-type: none"> <li>- A sense of appreciation is critical in prototype presentation.</li> <li>- Adding a "wow" factor sparked a level of excitement about the product. The group took the liberty of going beyond initial agreed-upon requirements and added extra functionality, which appealed to the client.</li> </ul>
3	<p>Manage participants' performance through class attendance</p>	<p>Two components:</p> <ul style="list-style-type: none"> <li>-Management of participants' performance</li> <li>- Measuring class attendance.</li> </ul> <p><i>Not obvious that performance was affected by attendance - Participants may not understand the link between performance and attendance</i></p>	<p><b>Name of the APP:</b> <i>Attend2perform</i></p> <p><b>Main functions:</b></p> <p>Physical attendance</p> <ul style="list-style-type: none"> <li>- Tracker – when a participant arrives in a class, the participant states 'I'm in class'. The tracker records the time and location</li> <li>- Messages – participant is able to messages</li> </ul> <p>Virtual attendance</p>	<ul style="list-style-type: none"> <li>- exceeded expectations</li> <li>- Face to face chat with support person instead of contacts</li> <li>- Very impressed with the name</li> </ul>	<ul style="list-style-type: none"> <li>- The depth of engagement with the problem facilitated new ways of perceiving the problem and facilitated the emergence of truly innovative solutions that generated new insights, even by the clients.</li> </ul>

	Problem to be Solved	Solution provided	Educational APP details	Functionality of the APP	Key principle learned
1	<ul style="list-style-type: none"> <li>- Extremely large classes</li> <li>- Difficult to track how the participants are doing in large classes – - assessment</li> </ul>	<ul style="list-style-type: none"> <li>- Tracker to alert lecturers on participants who are struggling and to facilitate a platform from which the lecturers and participants are able to communicate on their struggles decide on remedial work.</li> </ul>	<p>Name of the APP: <b>Edutrack</b></p> <p><b>Description:</b> Educational tracker with mark tracker, calendar, chats, social walls, blogs, contacts and podcasts</p> <p><b>Main functions:</b></p> <ol style="list-style-type: none"> <li>1. Alerts lecturers to the participants who are below average</li> <li>2. Facilitates chats with the whole group</li> <li>3. Facilitates private contact with participants</li> </ol>	<ul style="list-style-type: none"> <li>- Functionality to assess the participants who should be included.</li> <li>- Icons should be visually appealing</li> <li>- App is for the lecturer not the participants</li> <li>- Does not address the integration between the student and the lecturer</li> <li>- Obtaining feedback from the participants within a short time is critical</li> <li>- Access to tracker only by lecturer</li> <li>- The app should address lecturers not providing participants with feedback on time</li> </ul>	<ul style="list-style-type: none"> <li>- In a creative process, it is important to re-enforce a positive atmosphere, even if the result is still not good enough.</li> <li>- The process of co-creation must enable an atmosphere in which a client feels as much responsible as the provider for the prototype.</li> <li>- The demonstration of the prototype may trigger other ideas that did not initially exist. This is perfectly acceptable in a co-creation process.</li> </ul>
2	<p>It was difficult to engage the participants in the content and learning enforced in traditional ways.</p> <p>The solution had to be “cool”.</p>	<p>Develop content in such a way that a participant wants to interact with it and is excited about learning.</p> <p>One subject app, namely, biology</p>	<p><b>Name of the APP:</b> <i>sCoolApp</i></p> <p><b>Description:</b> Biology app that allowed interactive, graphical content specific app presenting material in ways that encouraged the participants to want to learn.</p> <p><b>Functions:</b> Chats, video content, social, news, calendar, twitter and Facebook etc. Surprise and wow feature: QR Quotes.</p>	<ul style="list-style-type: none"> <li>- The app is VERY cool and exceeded the expectation of the clients.</li> <li>-The clients loved the look and feel of the app and were happy with the functionality.</li> <li>- The clients asked for notifications if the participants were not in the APP.</li> </ul>	<ul style="list-style-type: none"> <li>- A sense of appreciation is critical in prototype presentation.</li> <li>- Adding a “wow” factor sparked a level of excitement about the product. The group took the liberty of going beyond initial agreed-upon requirements and added extra functionality, which appealed to the client.</li> </ul>

3	Manage participants' performance through class attendance	<p>Two components:</p> <ul style="list-style-type: none"> <li>-Management of participants' performance</li> <li>- Measuring class attendance.</li> </ul> <p><i>Not obvious that performance was affected by attendance - Participants may not understand the link between performance and attendance</i></p>	<p><b>Name of the APP:</b> <i>Attend2perform</i></p> <p><b>Main functions:</b></p> <p>Physical attendance</p> <ul style="list-style-type: none"> <li>- Tracker – when a participant arrives in a class, the participant states 'I'm in class'. The tracker records the time and location</li> <li>- Messages – participant is able to messages</li> </ul> <p>Virtual attendance</p> <ul style="list-style-type: none"> <li>- Live lessons – participants may be anywhere and click a button to prove attendance</li> </ul> <p>Support – list of all the people and contacts</p> <p>Interaction space – participants and lecturer support</p> <p>Reflections – participants must report back on the class.</p>	<ul style="list-style-type: none"> <li>- exceeded expectations</li> <li>- Face to face chat with support person instead of contacts</li> <li>- Very impressed with the name</li> </ul>	<ul style="list-style-type: none"> <li>- The depth of engagement with the problem facilitated new ways of perceiving the problem and facilitated the emergence of truly innovative solutions that generated new insights, even by the clients.</li> </ul>
4	Teacher professional development was requiring too much of the teachers. Often conducted on a Friday. Need for flexibility	Provide a mobile platform for teachers to learn from app	<p><b>Name of the APP:</b> <i>Eduleader</i></p> <p>Logo – recognisable symbols</p> <p><b>Main functions:</b> Links to the Department of Basic Education</p> <p>Live chat to allow teachers to interact with each other</p> <p>Suggestion box – anonymous interaction to send suggestions.</p> <p>Podcasts – further types of contents</p> <p>News – feeds for teachers</p>	<ul style="list-style-type: none"> <li>- Very impressed with the podcast concept.</li> <li>- Change the "news" item.</li> <li>- Resources link to provide teachers with access to other useful resources</li> </ul>	<ul style="list-style-type: none"> <li>- Went further and allowed the client to actually experiment and play with the app and also allowed natural interaction and opened up the way for the further development of ideas. It was also EXCITING for the clients and made the app a reality.</li> </ul>
5	Adult learners who require support. They do not have sufficient time at the college.	Interface for the adult learners to communicate, receive help as needed and hold discussions with one another.	<p><b>Name of the APP:</b> Msaada – Swahili word for "help"</p> <p><b>Main functions:</b></p> <p>News feed</p> <p>Alerts: schedule and assignments</p> <p>Facebook – social aspects</p> <p>Chat – participants engage</p> <p>Forums – content</p> <p>FAQ – Frequently asked questions</p> <p>Links to important websites and departments</p> <p>Documents – download policy documents</p> <p>Map of the institution</p>	<ul style="list-style-type: none"> <li>- More social icons</li> <li>- Links to websites outside of the campus?</li> <li>- The clients do not want directions</li> </ul>	<ul style="list-style-type: none"> <li>- Some of the agreements from the previous meetings not adhered to. Although the providers found the "directions" useful, the clients were adamant that they did not want the function. Willingness to let go was important.</li> </ul>

6	Low rate of digital literacy among college managers and they do not support mobile implementation in the faculty	Address first the literacy issue and then introduce the managers to the mobile technology that will assist them in their workflow	<p><b>Name of the APP:</b> My Activity Tracker</p> <p><b>Description:</b> Management activity tracking system that allows managers to track all activities related to teaching</p> <p><b>Main functions:</b> Chat Allocate tasks See overview tasks Send messages FAQs Tips and tricks Templates to use in classrooms Support Learn more about technology Personalised notifications Graphical depiction of task allocated and time taken to complete e.g. examination submission A responsive interface that automatically adjusts according to the device.</p>	Target was management and this app spoke directly to them. Far exceeded expectations. Allows management to appreciate technology.	Use of humour in the demonstration and the simulation of reality made the demonstration more real and exciting. Creatively framing a very difficult problem into an opportunity was clearly demonstrated by this group.
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## Appendix 6: Consent form filled by the ETILAB Participants



### CONSENT FORM

I, \_\_\_\_\_ do hereby give permission to the course convener of EDN4500 to use the artefacts created during and after the course for research purposes. I understand that I may choose to opt out and notify the convener not to use my contributions at any time.

I am aware that my name will be altered to protect my identity in the written document.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_



## Appendix 7: A course evaluation form sent out after the course

Can be found of this link: [https://docs.google.com/forms/d/1cTqz\\_osM2bcwalDBOGIAKrHIm3TPBrw-I8wB6lWl9l0/edit#](https://docs.google.com/forms/d/1cTqz_osM2bcwalDBOGIAKrHIm3TPBrw-I8wB6lWl9l0/edit#)

### EDN4502 Course Evaluation

This student questionnaire is based on the UCT's Teaching & Learning Charter which guarantees minimum teaching standards to students. Please complete this form as comprehensively as possible.

1. What aspect of the week did you appreciate or value most?

2. What aspects of the week did you find particularly difficult?

3. Which themes did you find most useful during the week? (please select four)

- ☐ Theme #1: Context - Mobile Space
- ☐ Theme #2: Mobile Frameworks
- ☐ Theme #3: Design Based Research
- ☐ Theme #4: Design Thinking
- ☐ Theme #5: Hermeneutics theory

Explain your answers:

### Rate (with comments) the learning activities offered during contact week

4. FRAME - Framework for Rationale Analysis of Mobile Education

5. Design thinking processes

**6. Role play of client/developer****7. Reflecting on own learning in PB Works****9. Podcasts****General considerations****11. What aspects of this week's course do you think need attention or could be improved?****12. Please comment of the quality of the course reader****13. Please comment on how technologies were used in the course (modelled)****About course cordination****14. Comment of the course covener(s)' facilitation of the course**

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15. Comment on the teaching approach used in the course

16. Was the teaching strategy used during the week flexible, and did it accommodate your learning needs?

17. Did the content covered during this course meet your expectations and needs?

### Comment on resourcing of the course

18. Was the venue appropriate and did it provide a conducive learning environment?

19. What is your comment on the technical, IT support provided?

20. Did the course encourage students to work together and learn from each other?

21. Was the course pitched at the correct level for you to be able to engage meaningfully?

22. If you have done all four modules in the PGDip programme, please comment on the sequencing/order of the modules (e.g. does this module fit well as the final module of the programme? or would you like to make suggestions on how best to align the order of the modules?)

23. Has this final course contributed to your own development/expanded you worldview/changed your thinking in terms of educational technology teaching & research

## Final remarks

Any other feedback or comments about the course this week?

thank you!!

Add item ▼

Confirmation Page

Your response has been recorded.

- ☒ Show link to submit another response
- ☒ Publish and show a public link to form results ?
- ☐ Allow responders to edit responses after submitting

Send form

## Appendix 8: Feedback from the above evaluation related to this study

### Responses from the ETILAB PArticipants

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#### Summary

#### 1. What aspect of the week did you appreciate or value most?

- \* Emphasizing the process (DBR) one goes through when developing apps for mobile learning was very important. It is crucial to first theorize the problem based on learning theories before one can propose the appropriate pedagogical strategies that can be deployed into the developed app. The design thinking approach was also another one I appreciate in case one had to develop an app in a relatively shorter time.
- \* I drew a lot of inspiration, motivation and drive from class peers and so feel that my learning was enhanced by this. So the model of group learning was valuable to me
- \* The perfect sequencing of the provision of information. Essentially the learning took place exactly when we needed. This allowed a very steep learning curve.
- \* Design Based Research Design based thinking principles Creating Apps in authentic learning contexts
- \* The practical way in which we approached the Design Thinking process was very valuable as we could apply the theory and learn at the same time (from our mistakes)
- \* Mobile application development
- \* Liked the Designed based Research and Design thinking approaches and the fact that we were able to conceptualize problems and build mobile apps. Liked the fact that we had talks from leading experts in ET research as well as interactions with them - This is very priceless. Additionally, the course is based on research which is great
- \* The designing of a mobile learning app.
- \* the grounding in theory the demonstration of the possibilities of online lectures through Adobe connect was phenomenal the practical component of developing an app group and individual presentations

- \* Interactions aspect because it helped me to learn and understand from different people.
- \* I really got excited with the practical implementation of the mobile learning. It really made me think of how i could apply this to my context and even better i am looking forward to the final product where the proper time and feedback and really solve an authentic problem in your context. The collaborative activities in groups, presentations from other researchers e.g Jan Harrington
- \* I appreciated being given time in class to explore the technology for ourselves with the lecturers presnt to help guide us. I loved practically producing a product for a client and then going through the process of "improving" the app to suit their needs. The presentation of the prototype was great fun, and a valuable exercise
- \* I thoroughly enjoyed the design thinking process and actually making an app
- \* Design thinking and the attendant activities that we went through. It was interesting though quite involving to actually experience the process right from the Empathy Stage, Define, Ideate. Prototype, through to the Test stage. The culmination into a workable App was quite a take home.
- \* I really enjoyed the entire week. I feel that everyone who presented added to my my learning. I'm appreciative of the opportunity to be able to attend this module and would gladly recommend it to anyone.

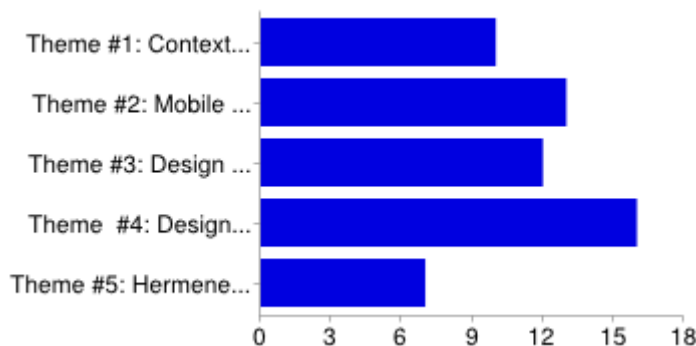
## **2. What aspects of the week did you find particularly difficult?**

- \* Working and creating mobile app features
- \* I've really immersed myself in every single aspect and therefore cannot find any fault. We also have a wealth of knowledge in lecturers and classmates so one could alway ask questions. Live this new Teachback approach.
- \* The first day was a heavy in content without providing us with some scaffolding. I would have appreciated having Jans' lecture on the first day so that I knew what to expect for the rest of the week.
- \* I do overall struggle with the theory behind it since this would be the first time ever that i am expose to theory behind education. I do however feel that with research i will find the theorist

that will be the foundation of my research.

- \* Using of the application AppMakr
- \* Beginning of the week was quite stressful because of the overlap between the tasks of this module and a coursework from the last module
- \* It was an intense Week which is really packed and the difficulty lay in the fact that we had an overflow of coursework from the previous course. Otherwise, the difficulty and challenge can be seen as opportunity to ground our selves in the field of mobile learning and being positioning ourselves as the new innovators of this century
- \* I have nothing specific to say in this regard. My challenges are personal: grappling with my role as a student, doubting my abilities and so on. This module provided scaffolding in the classroom that in a way addressed these insecurities
- \* I did not find any aspect difficult.
- \* Having to think through the problem that I have to address for my essay. It became quite challenging to determine the scope of what I have to address for the essay.
- \* Trying to manage tasks from two modules whose assignments are now overlapping led to divided attention especially in the first two days which affected my promptness in reflecting on day's work
- \* Keeping in tandem with the massive tasks whether individual or group that we had to accomplish. Solving the software matching/needs problems.
- \* This is more on the technical side: The PBworks programme was not that user-friendly to me. I lost information twice as the platform "froze" while saving and then the information entered last was not saved.

### 3. Which themes did you find most useful during the week? (please select four)



**Explain your answers:**

The 4 themes developed my conceptualization of mobile learning and its practical execution and evaluation. Although I am being limited to ticking 4 , hermeneutics theory provided me the principles of interpreting texts and situation without bias and preconceptions

Theme #1: Context - Mobile Space	<b>10</b>	62.5%
Theme #2: Mobile Frameworks	<b>13</b>	81.3%
Theme #3: Design Based Research	<b>12</b>	75%
Theme #4: Design Thinking	<b>16</b>	100%
Theme #5: Hermeneutics theory	<b>7</b>	43.8%

- \* #1 I have a better understanding of the space that mobile learning occupies in the educational environment. #2 This theme helped me to unpack the aspects of mobile learning that should be considered and evaluated when planning a mobile solution. #3 This theme was useful in cementing my understanding of DBR and bringing together the different modules covered during this programme. #4 It challenged me to think innovatively and creatively and to challenge boundaries. I found these sessions very inspiring.
- \* A conclusion was quite made that 'context is everything' Mobile frameworks are a good way to follow through or guide mobile learning interventions DBR lends itself to Design thinking and allows for re-evaluation of solutions.
- \* The mobile frameworks were useful in evaluating the appropriateness of an ideal app for mobile learning. Design based research was important for creating awareness that one has to follow a systematic process that is grounded in theory when carrying research on emerging technologies in education Design thinking is one way in which feasible solution for mobile learning can be created in a shorter time. Hermeneutics theory is important for emphasizing the importance of interpretation of context and problem spaces without any prejudices, else bias will created in the solutions we provide.
- \* I found all the themes interesting. Because hermeneutics is least known to me and to use it for



the essay would take most effort because of the learning curve I left it off the list. If possible I would have chosen all the options

- \* Theme #2; My question before Monday was what is mobile learning but when that was sorted out mobile frameworks become easy for me to understand of course with the help of the FRAME model. Theme #3; The iterative process and using authentic processes I believe make research improve mobile learning. Theme #4; The aspect of diverge and converge I believe makes it possible to come up with good ideas in making decisions. Theme # 5; The idea of the part and the whole helps strengthen the FRAME model.
- \* The frameworks help guide research and allows us to use them as lenses to frame/understand context Design based research provides practical ways in which to conduct research studies and therefore i am going to get my MSc students to try this out Design thinking provides an agile-like approach which allows researchers to think outside the box and innovate.
- \* Theme 1 gave me the opportunity to look at my context in a more focused way and to see what was really happening as far as enablers and constraints are concerned. Themes 3 & 4 provided me with a framework and theoretical underpinning for future use. I will also be able to lead the team at work in a more constructive way.
- \* Mobile frameworks were useful as a follow-up to the affordance analysis principles which were tackled in the previous module. DBR and DT were important in informing the arguments about executing useful research. Hermeneutics as theory was important in acknowledging the need to unlock our beliefs in extending the possibilities of mobile learning.
- \* The four inform my understanding and analysis of mobile learning applications development
- \* Again here i was more interested or drawn to the practical aspects of the course. The Hermeneutics theory was also interesting although i did not tick that off but i think there could be great value in that foundation. I feel that all themes contributed to a great course
- \* Context: It helps and reminds me about contextualizing my research Mobile frameworks:
- \* I enjoyed the logic behind this theme. Its framework allowed me to practically apply it to my problem
- \* Although DBR was useful, I do not quite see how it will fit into my context. Design thinking is simpler to understand, maybe because we spent more time on it so I find it easier to use.

- \* My interests lie in why more than how things work, but how is a close second. The how is always more exciting after the why is sorted out.
- \* The 4 themes developed my conceptualization of mobile learning and its practical execution and evaluation. Although I am being limited to ticking 4 , hermeneutics theory provided me the principles of interpreting texts and situation without bias and preconceptions

#### **4. Design thinking processes**

- \* We got an opportunity to 'live' the process which was very good. We have outcomes to offer and demonstration of an App.
- \* Design thinking process was an amazing process, that enables one to develop applications in a shorter while empathizing with the users in the process.
- \* Design thinking processes was helped me to tailor my way of understanding. And I am feeling much confident on this model. The idea of diverge and converge I believe gives more options to ponder about the choices made.
- \* This was a useful activity as we were challenged - we had to think out of the box and it made the activity exciting. The creation of the prototype was also a trial and error activity, but it taught me so much. I have more confidence to work on a prototype at home now - and I know that I can call on my group and others in the bigger group if I need help.
- \* very good as it gave us opportunity to learn while doing.
- \* Excellent - we were taken through the process step by step during the design and development of our app. Great and also very valuable.
- \* The learning activities have been both authentic and abstract to encourage imagination, creativity and innovation.
- \* The value of this process became evident through the practice of the group task this week. I found it extremely useful as for me it fills some aspects that may exist as implicit in project management. These aspects need to be foregrounded as we operate in a cultural-social context. Hence the view of the value
- \* Great, we really enjoyed using this for our clients problem. Great presentations too. 5/5 - Informs my way of considering how to approach the user.

- \* Loved it
- \* This was a very useful approach as it allows you to innovate and develop rapid prototypes in a rather quick/short time
- \* More than 100%. Puleng did very well. The way it was scaffolded, quite engaging and exciting. Considering that design thinking can not really be taught
- \* Provided me systematic principles for analysis and intervention within mobile learning

### **5. Role play of client/developer**

- \* This really helped especially that I'm coming from a background where I haven't used most of these technological tool. Peers were able to scaffold where I was not clear.
- \* Really enjoyed the interactions. Adding it to my toolbox
- \* It was a very good experience and authentic. It felt like a real life situation.
- \* Role play was also superb. It enabled me to step in both the shoes of a client and the developer. Gaining such as experiences able one (who has gone through this course) to reflect on both roles when designing an app for mobile learning.
- \* Provided me with an authentic learning contexts to learn and implement mobile learning interventions to educational problems Useful as part of understanding the design thinking process
- \* 10/5 - taught me more than I can say. This immersive learning process allowed me to establish a real rich frame of reference.
- \* This was an authentic learning task, as I have experienced what it is like to give the client what they need and to get feedback on what we have missed.
- \* Allowed empathy and thinking oriented to presenting a real world problem
- \* Excellent - our tasks were authentic and we were mentored well in developing empathy and making a pitch.
- \* My favourite part of the week. Allowed us to apply what we had learnt in the week. The process of learning through trial and error was great, and Puleng gave very useful feedback
- \* Challenging to work in teams at first but it ended up very interesting and enganging. It gave me a feel of dealing with clients in the real world.

- \* This was very useful as it talked to the different Design thinking phases and allowed us to reflect on the things we did wrong and what we did right
- \* This was really fun and kept the energy levels high.
- \* well executed as a method of teaching. groups cohesiveness was well maintained
- \* This really helped especially that I'm coming from a background where I haven't used most of these technological tool. Peers were able to scaffold where I was not clear.
- \* Really enjoyed the interactions. Adding it to my toolbox
- \* It was a very good experience and authentic. It felt like a real life situation.
- \* Role play was also superb. It enabled me to step in both the shoes of a client and the developer. Gaining such as experiences able one (who has gone through this course) to reflect on both roles when designing an app for mobile learning.
- \* Provided me with an authentic learning contexts to learn and implement mobile learning interventions to educational problems Useful as part of understanding the design thinking process

#### **6. Any other feedback or comments about the course this week?**

- \* Very effectively managed and coordinated. Enjoyed the course contents and activities. Yet to explore more on mobile development Great year, challenging and opening up so many new opportunities.
- \* Keep it up.
- \* Though quite demanding, there are no regrets whatsoever that I had the opportunity to offer this course
- \* I have enjoyed this module in such way that it has changed my way of thinking. I am confident to involve on research and evaluation of ETs. I see myself as a problem-solver.
- \* Thank you for the opportunity
- \* Well done... This was the icing on the cake. A very worthwhile course
- \* This was the best course of the year. The way it was structured, the relaxed (not slack) mode of delivery despite being pushed hard Well structured, exciting especially the collaborative tasks, getting to get an application working in a few days!!!! wow

- \* Good that we have managed to come this far it takes lots of commitment to keep changing roles as full time employees the grouping of students for group tasks i felt was well thought about.
- \* Very rich course.
- \* It was such a great course! Thank you Dick, Puleng and Dorothy.

## Appendix 9: Thematic Analysis of the data from the ETILAB

### Comments and Reflections

The following comments were obtained from the transcribed class reflections and video interviews conducted at the end of the programme. *These are available on request.*

- I. The question asked in the reflections in class was: how has the journey of this course impacted you, and the comments in **red** below are obtained from the transcription notes.
- II. The following questions were asked in the video interviews:
  1. How did you feel on Monday when you arrived and were told that by Friday you will have developed mobile APP that addresses a challenge in education?
  2. What were your key learnings from the problem definition journey you took with your client?
  3. Now that you have developed the app prototype, how does it feel?
  4. What are your last reflections on the journey?

Using thematic analysis, all the comments were clustered according to emerging themes used in this study.

**Red** = Reflections

**Black** = comments from video interview

### Engagement

*The process has been very engaging for all of us while developing the app for the client*

### Environment

*Awesome course, awesome planning.*

*It was very interesting, I enjoyed that very thoroughly.*

*Thank you for the passion, it's contagious!*

### Empowerment

*The design thinking process: it opened my mind..., it liberated my mind. It has changed my whole outlook.*

*I have always known I am a creative that was a nice but it was also nice to take my thinking process and actually put into the "bottle", knowing what I've been doing.*

*My thinking has definitely changed, the way I look at things, the way I look at problems, that's the main thing I've gotten here and the experience of actually using an app and believe that you can do that in few days and it can be used by other people to solve problems, thank you.*

*I'm glad that... and also that now I'm employed becoming a practical practitioner of using mobile apps and ICTs in general. Maybe one credit to the entire team that was convening this, you demonstrated role plays and method of teaching effectively, thank you.*

*...by the energies of other people, ...because they kept on watching us, what are we going to do next, and that drove us to something else, all the time, and I enjoyed it. And because we were marked as those ones who broke the rules, we could broke more rules, we were now in capital.*

### **Empathy**

*When you want solve a problem be in the shoes of that person that's how you can solve the problem.*

### **Learning**

*I came in with preconceived ideas of mobile learning as well as prejudices towards it, I'm leaving knowing that there's possibilities for mobile learning.*

*I really enjoyed learning about the processes and developing apps, the science behind it and I really did enjoy the practical application of it with the clients, the whole process of presenting to them, getting feedback making changes and improving.*

*I benefitted significantly from group learning this week and my horizons have broadened tremendously in terms of what could be done in my context with mobile technologies.*

*This course taught me something I haven't thought of before.*

*I think what was really great about this course was the practicality of it and the actual application, so it wasn't just sitting and listening to somebody, we actually built something and through the process learnt from experiential perspective which was great.*

*It's been a very interesting week Puleng, we've learnt so much about using Creative Design to create apps for the problem that was given to us by our colleagues.*

### **Inspiration**

*This course has really inspired me to tap into my creative side which I really didn't think that I had and I think it an amazing way to get me to find solutions and to be creative about solutions that I find to the challenges that I identify, normally when I had look at finding solutions used to be a very boring kind of plotting, long way without looking... and the Design Thinking process, the way that was delivered to us and practical experience we had walk in through that, I think I will take that with me and practice it. I really enjoyed it.*

*I think this has a nice way to end the course, I mean to end the entire programme because I just get the feeling that we've been prepped quite nicely to go out there and save the world hopefully.*

### **Ambiguity**

*With your help I felt more at ease.*

*I didn't have any clue, in the end I know how to do it and I'm confident to go out and develop more apps.*

*The idea of creating an app: Curious but very apprehensive.*

*It was a daunting task, we could not imagine ourselves developing an app within 5 working days, actually*



*by Monday there were 4 remaining days but we went in, with a positive, and with thinking Design thinking, we launched ourselves into it.*

*I thoroughly enjoyed the entire process working with the client and trying to see what we can do together in order to the demands they had and with challenges.*

*Not that at ease because I've never done anything like that, so I was a bit stressed.*

*I was thinking 'oh dear, programming, I'm not gonna make this, I was thinking more it was intense programme.*

*I went like what! I was in shock because I imagined those kinds of things are done out there not me.*

*When I started this week I didn't even know what mobile learning was really, but being able to go through all the activities then coming up with an app that can actually work on the computer, I really feel very very blessed to be able to have these practical skills that I'm very eager to go out and try out.*

*When you said that by the end of the week we will be creating an app, I was thinking to myself "are they are out of their minds", what's really going on because I don't know the secret behind these apps, it could be a lot, not even a week, it could take us even 3 months or so, even more, but just a few sessions that we had, I was like, everything was coming into light as if it was God saying, "let there be light", and there was light, so that was exactly happening...*

### **Emergence**

*The eduTracker was developed to help the students that are actually struggling.*

*Now, I actually feel that the sky is not the limit because if we can do in couple of days with the client... what would do with more time?! I'm looking forward to designing an applications.*

*I've enjoyed this module in such a way that it has changed my way of thinking and I see myself as a problem-solver out there.*

### **Diversity**

*With this module I think it really help so much, I like the comment that we (are) coming from different contexts and we really need to come up with authentic mobile apps for our context so Africans should*

*develop mobile learning apps that are suitable for their context.*

*I'm glad that and also that now I'm employed becoming a practical practitioner of using mobile apps and ICTs in general.*

*We were searching for a name that encompasses what we wanted to do, so we were thinking in African context of names, for example like "vula", that means something, and we looked at Zulu words, we looked at Afrikaans, we looked at English, we came across Swahili and we thought Swahili would be good, that's how the name came about, for the app.*

### **Experience**

*I'm happy we are not here just to learn, but we've actually lived the experience of learning, I liked the Design Thinking process and all the activities, I'm also happy that we interfaced with John Harrington since John Harrington is a big name when it comes to mobile learning, thank you.*

### **Practical**

*I'm gonna echo a lot of what people said, I really enjoyed the quite excellent the mix of theory and practicality that we experienced in this module and I thought Puleng was great and that whole Design Thinking process, that was very unexpected and I think, very beneficial.*

*I can't sum it up better than that but it's been really great and I really enjoyed practical application that we've been learning about in class. I hope that our clients are just as happy as they were, early in class.*

*It's not only about just finding technological solutions it's what we learnt, the process of getting to the point then one starts applying the technology...*

### **Creativity**

*Eduleader was something that came up about two in the morning in the computer labs, I created this logo on a programme.*

*I actually designed the 'logo' of the app by hand which was cool.*

*It was a process actually, because I think we came up with 'Real Cool app' and then 'Cool app' and then I was sitting one of the evenings and then I thought "oh, the cool group wanted a 'Scool app'", so "Scool app" evolved.*

### ***Diverging and converging***

*I benefitted a lot from the theory and practice that we have gone through and the whole process of thinking and diverging and converging until we came up with a solution, I've also benefitted from so many things, I was able to adapt Marketing skills because you had to convince your client to take up something, so it was not only about educational technologies but how you can market your product and how you can understand your client and convince them and produce something they can accept.*

## Appendix 10: Africa Science Leadership Programme (ASLP)

### Interim conference report for the inaugural training workshop

#### Theme: Leading a New Paradigm for African Science

7-12 June 2015

The intent with this interim report is to summarize information about the first inaugural training workshop of the ASLP. Further analyses and summaries of the week's experiences, people, program and projects are currently being written and will be shared in due course.

The development of the program followed a preparatory workshop including the University of Pretoria (UP), Global Young Academy (GYA), Leopold Leadership Program (LLP), Collective Leadership Institute and KnowInnovation (KI). Further engagement and development by various partners, in particular between KI, UP and GYA, as well as consultation of LLP, followed between March-May. The program takes significant elements from the LLP and tools linked to creative problem solving and leadership developed by KI, but also combines a number of new elements and inputs from local partners in South Africa; delivering to a unique program. Continuous interaction and evaluation by the KI, GYA and UP members during and after each days' activities were used to shape the program actively to respond to its flow, development and the interactions with this particular group of fellows.

### Sunday, 7 June

Time	Activity	Leadership Objective
14:00	Arrivals & Afternoon Refreshments	
16:00	Actual Start / Welcome Welcome: Bernard Slippers Workshop Objectives Introduce Facilitators	Leading a new paradigm for African science!
16:15	Building the Container KI introduction Broad Agenda Preview (MD) Climate Setting Helps/Hinders (TM) Sense of how we will work this week (PM)	Creating a climate that supports collaboration and shared leadership.
16:45	Talent, Expertise & Perspectives Who's here in the room, and why Picasso Activity Knowledge Exchange: profile posters <ul style="list-style-type: none"> <li>About me: my work &amp; myself</li> <li>What I bring: talent &amp; expertise</li> <li>IMO, the biggest challenge for the next generation of leadership is...</li> </ul>	Understand the capacity in the room, as essential to shared leadership process.
17:45	Quick Process Set-up/Skill Building Reiterate the reason for listening for problems/challenges, to figure out what's stopping us... The art of productive questions Moving from Problems to Challenges	Inspiring thinking about productive thinking
18:00	Reflecting on Leadership Opening Speaker: Prof Derick de Jongh Albert Luthuli Centre for Responsible Leadership Presentation 20', Q&A 10'	Responsible leadership: the bigger picture

	Table Talks/Harvesting Questions 20'	
18:55	Preview tomorrow and the week	Preparation for the next day
19:30	Dinner & socializing	

**Monday, 8 June**

Time	Activity	Leadership Objective
9:00	Meeting Open	
9:25	Set-up (Challenges) Harvest questions from last night's presentation	Productive Questions Invokes thinking and setting the tone
9:40	Inspiration/Provocation Prof Cheryl de la Rey Vice-Chancellor, University of Pretoria Presentation 40', Q&A 10' Table Talks/Harvesting Questions 15'	Leadership in higher education in Africa
10:35	Break	
10:55	"Talking Stick"	Free expression of thoughts
11:00	MindMap on Leadership Group reflection on "what is leadership?" Pairs, Combined Pairs Compare and contrast Report highlights	Breaking down and re-building the term
11:40	Inspiration/Provocation Mr Ben van der Merwe Albert Luthuli Centre for Responsible Leadership Presentation 20', Q&A 10' Table Talks/Harvesting Questions 20'	A framework for leadership theory - what is leadership?
12:40	Lunch	
1:40	Talking Stick	Free expression of thoughts
1:45	Active Listening Trios Speaker/Listener/Scribe What are the leadership challenges you face? 3 X 5:00 Active Listening Process 1 X 5:00 Trio Regular Discussion Group Debrief (content & process)	Participants reflect on their own observations and challenges about leadership within the realm of science in Africa
2:40	Inspiration/Provocation Dr. Willem Fourie Albert Luthuli Centre for Responsible Leadership Presentation 20', Q&A 10' Table Talks/Harvesting Questions 20'	Research and the conversation on leadership in Africa
3:30	Break	
3:45	Random group forming (first letter...) Future External Influences Using the PESTLE model 20" at tables on topics presentations and mapping 20" Discuss and debrief What questions come to mind: add these to the wall	Envisioning and deconstructing potential future scenarios.
5:15	The Reflective Leader Recap Cheryl de la Rey's 3 points, that a scientist leader is: - Discoverer/explorer/transformer - Engaging - Global/local  1. Reflect privately, on how I, as a leader, embody these things 2. Tell a neighbor (optional)	Thought provoking discussion that emphasizes important points for the day
5:35	Vote with your Feet Agree/Disagree in four corners	Energizing activity that inspires socializing
6:15	Dinner & socializing	
7:45	Evening Activity	Having respect for others ideas

## The Art of Deferring Judgment

## Tuesday, 9 June

Time	Activity	Leadership Objective
9:00	<p>Meeting start Introduce Prof Tinyiko Maluleke</p> <p>The "Recap" Break into four sub groups: 1 - Sunday afternoon 2 - Monday morning 3 - Monday afternoon 4 - Monday evening In four subgroups have 10-minutes to discuss and prepare a short report on what happened during the sessions earlier this week.</p> <p>Late arrivals go out with Tim to do their Picasso portraits and Me-sheets.</p>	<p>Tinyiko Maluleke to join as mentor for the morning.</p> <p>Reinforce activities &amp; insights so far, and to bring late arriving participants up to speed.</p>
10:15	<p>Questions and Wisdom</p> <p>In small groups, prepare questions that you have for a wise elder who can give you guidance to help you succeed. Prof Maluleke receives the questions and answers them. Any How to's to add to the challenge wall?</p>	Reflection on leadership, and further to take advantage of the wisdom and spirit of Prof Maluleke.
11:00	Break	
11:15	<p>Mapping the Landscape of the Challenge Affinity Clustering &amp; Categorizing</p>	Collective categorize elements of the challenge and even prioritize them.
12:30	Lunch	
13:30	<p>Confirming Shared Understanding Synthesizing the Clusters Prioritize clusters, form pairs or trios to unpack the key ones. Debrief: what's missing, what's surprising, etc.</p>	Confirmation of shared understanding about the leadership challenge
15:00	<p>Presentations Short (very) summaries of synthesized clusters</p>	As above
15:45	Break	
16:00	<p>Preferences and Leadership Review the Foursight profiles and talk about creative preference and how this impacts collaboration. Thinking also about preferences in the view of leaderships.</p>	Educating fellows on profile importance as an individual and group member
17:00	Reflection	Emphasis of the important points of the day
18:30	Dinner & socializing	

## Wednesday, 10 June

Time	Activity	Leadership Objective
9:00	<p>Meeting Start Opening Activity</p>	Lorenzo Fioramonti to join as mentor for the day
9:30	<p>Creative Skill Building Guidelines for collaborative creative thinking.</p> <ul style="list-style-type: none"> <li>• Diverging guidelines</li> <li>• Defer judgment (accept offers)</li> <li>• Third</li> <li>• Converging: affirmative judgment</li> <li>• NINE DOTS activity</li> <li>• Debrief</li> </ul>	As a leader, how to set the stage for creative collaboration. What is the mindset you need to cultivate?

10:15	Generating Initial Ideas (Round #1) Vote with your feet toward synthesized challenge cluster that attracts you.	In search of ideas to support shared leadership practices.
10:25	Group Work Go off in these temporary working groups and generate ideas to address the challenge.	Generate ideas to address leadership challenges
11:00	1-minute Raw Idea Presentations No Q&A, no feedback, these are just the first notes of raw ideas. Too early to comment. (Standing Circle)	Presenting raw ideas
11:15	Break	
11:30	Generating Initial Ideas (Round #2) Vote with your feet toward a 2nd synthesized challenge cluster that appeals to you. Generate ideas to address it.	In search of ideas to support shared leadership practices
11:35	Group Work Go off in these temporary working groups and generate ideas to address the challenge.	Generate ideas to address leadership challenges
12:15	1-minute Raw Idea Presentations No Q&A, no feedback, these are just the first notes of raw ideas. Too early to comment. (Standing Circle)	Presenting raw ideas
12:25	Debrief the morning	Reflection on morning
12:40	Lunch	
13:45	Vote with your Feet Using the Agree/Disagree corners, a few prompts to determine readiness to select a project idea and begin to develop it.	Energizing activity that inspires project selection
14:00	Selecting Pertinent Projects Form groups around ideas of interest	Free choice of interest for projects
14:15	Prototyping Project Ideas Groups go off and very quickly sketch out their ideas, enough to make a quick presentation and get initial feedback. (Break Included)	Working on actual projects to inspire/empower shared leadership
16:00	Peer Feedback Skill Building PPCo (Dog-o-Matic) Set up using it for presentations	Sharing the responsibility of enhancing a project, collectively.
17:15	Presentation of Project Ideas Round #1 Each group 5 minutes PPCo on each presentation	Opportunity to share ideas on the relevant project open for feedback
17:15	Reflection	Emphasis on important points of the day
18:30	Dinner & socializing	

## Thursday, 11 June

Time	Activity	Leadership Objective
9:00	Meeting Start Opening Activity	Raise enthusiasm for the day
9:10	Provocation: Sarah Wild (M&G) Activities to do with <ul style="list-style-type: none"> <li>• Outreach strategies</li> <li>• Constituencies, etc</li> <li>• Making science easy to access</li> </ul>	Raise awareness about communication strategies that are part of good leadership.
10:00	Developing Project Ideas Groups work to develop their projects further, taking on board the feedback from the PPCo, prepare for presentation round #2. (Break included)	Experience of shared development of ideas, as feedback is incorporated and makes ideas more robust.
11:30	Presentations Project Ideas Round #2 (part 1) With PPCo feedback Three presentations before lunch	Opportunity to share ideas on the relevant project open for feedback
12:00	Lunch	

12:30	Game Drive (Only because the group asked for it!)	Social activity
1:45	Presentation Round #2 (cont'd) With PPCo feedback Four presentations	Opportunity to share ideas on the relevant project open for feedback
2:30	Review of PPCo Groups go over the peer feedback; mentors roam and chat with people to make suggestions. Possibly some group merging or project connection.	Thought provoking challenge about the realities of projects
3:00	Future Headlines Thinking ahead to the future (use also the PESTLE wall) imagine your project having maximum impact. What's the headline? Groups work 30" Quick Presentations 10"	Invokes imagination and passion for future success
3:45	Break	
4:00	Sticky Steps Action Planning Present the tool	Introducing a tool that helps an outcome be achieved by working backwards
4:10	Action planning Using the "future headlines" as an ideal outcome, working backwards (Sticky Steps) to develop action steps for proposed projects.	Including the development of a mentorship plan. Who is the right mentor for a project, and how will we engage them?
5:00	Reflection	Emphasis of the important points of the day
6:30	Leave for dinner	
7:00	Dinner at restaurant & celebration of the experiences of the week	

## Friday, 12 June

Time	Activity	
8:30	Meeting Start	
8:45	Project Management (4-types)	Educational session on project management
9:30	Quick thoughts on Branding Borrowing from Marketing to think about communication strategies for your project. The language of marketing and thinking in terms of Value Proposition	Offering marketing concepts as tools for project exposure
9:40	Group Work on Pitches In project groups, craft the language for the core of your "elevator pitch" and think of different audiences and how to convey/transmit to them the essence of your project so that they will support it.	Forces groups to summarize important points and express them in a captivating way
10:45	Break	
11:00	Quick Presentations (up to 2 mins)	Sharing of pitches with group
11:20	Structured Reflection What has this week brought to you? How has it changed you and your thinking about leadership? <ul style="list-style-type: none"> <li>Individual Free writing</li> <li>Full group Debrief</li> <li>Review the week</li> </ul> Two prompts: <ul style="list-style-type: none"> <li>What will you do differently next week, as a result of this workshop?</li> <li>Who have I become as a leader?</li> </ul>	Personal reflection with regard to the week's activities and outcomes
12:15	Final Closing Comments/Logistics Details about staying in touch, etc.	Networking and exchanging details
	Feedback on the Experience PPC/o or other reflection	Highlighting the objectives of the week
	Closing Circle- Shine the Light	Literal activity of sharing light and therefore ideas and assistance in future
1:00	Finish & Lunch	



## Appendix 11: List participants in the ASLP Sandpit programme

Department/Institute	Institution	Gender	Country
Linguistics	Addis Ababa University	M	Ethiopia
Pharmacy	Addis Ababa University	F	Ethiopia
Adult Health	University of Ghana	F	Ghana
Crop and Soil Sciences	Kwame Nkrumah University of Science & Technology	M	Ghana
English and Linguistics	Kenyatta University	F	Kenya
Health Sciences	University of Mauritius	M	Mauritius
Political Science and International Relations	Mohammed V University	M	Morocco
Molecular Epidemiology and Diagnostics	Eduardo Mondlane University	M	Mozambique
Microbiology	University of Benin	M	Nigeria
Pharmacology, Therapeutics and Toxicology	University of Lagos	M	Nigeria
Chemical Sciences	Redeemer's University	M	Nigeria
Genetics; Forestry and	University of	M	South Africa

Agricultural Biotechnology Institute	Pretoria		
Political Science	Nelson Mandela Metropolitan University	F	South Africa
Advanced Materials	Mintek	M	South Africa
Biological Sciences	North West University	M	South Africa/ Nigeria
Education	University of Pretoria	F	South Africa
Built Environment and Education	Uganda Martyrs University	F	Uganda
Clinical Pharmacology	University of Zimbabwe	F	Zimbabwe
School of Pharmacy	University of Zimbabwe	M	Zimbabwe
Institute of Immunology and Infection Research	University of Edinburgh	F	Scotland/ Zimbabwe

## Appendix 12: List of projects in the ASLP Sandpit programme

### Title: Science Leadership: An African Perspective (SLAP)

**Description:** This project focused on redressing the problems of African scientists with regard to science leadership and management skills. As such, the focal point of the SLAP working group was to produce review of existing literature in science leadership in Africa, develop a curriculum for African science leadership and motivate their colleagues to work on mentorship.

**Members:** Jose Fafetine, Olubukola Babalola, Etinosa Igbinosa, Dexter Tagwireyi and Mariamawit Yeshak

### Title: Flexible Thinkers for Future Africa

**Description:** Although there is a wealth of educational material available on the world wide web, this is largely inaccessible to the majority of learners in Africa as they do not have high-speed internet connections. The project aimed at looking for ways to increase the awareness of these resources and also creating offline access through more accessible media than was the case at that time.

**Members:** Eshchar Mizrachi, Vidushi Neergheen-bhujun, Vincent Logah, Connie Nshemereirwe and Lydia Aziato

### Title: Coming to Africa

**Description:** This project aimed to probe the values of African culture as regards effective leadership and to cultivate an inclusive mind-set by bringing together willing scientists and community elders.

**Members:** Mariamawit Yeshak

### Title: Gender and Science in Africa

**Description:** Gender and Science in Africa was a project that aimed at promoting and

fostering female, African Leadership in science by embarking on an ongoing research agenda that would address cross regional and trans-disciplinary issues related to the question of gender and science across Africa.

<https://www.facebook.com/africanfemalescientists1>

Members: Badre Abdeslam and Surette van Staden

#### Title: Africa Science Funding and Embracing African Science

Description: This project sought to assess the status of science in Africa in three critical areas: namely, an assessment of the research is produced in the various African regions, an assessment of the level of interdisciplinary research with a focus on crafting holistic solutions to Africa's challenges and an assessment of science funding in Africa.

Members: Joleen Kotze, Binyam Mendisu, Salerwe Mosebi, Alice Matimba, Franscisca Mutapi, Emmanuel Unuabonah, Fridah Kanana and Abidemi Akindele

## Appendix 13: Consent form filled by the ASLP Participants



### CONSENT FORM

I, \_\_\_\_\_ do hereby give permission to Puleng Makhoalibe to use my feedback from the African Science Leadership Programme for research purposes. I understand that I may choose to opt out and notify her not to use my contributions at any time.

I am aware that my name will not be used to protect my identity in the written document.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

## Appendix 14: A questionnaire filled by the participants after the workshop

### Please rate your ASLP experience

Your response is highly appreciated and will help us help you! It only takes a few minutes minutes!

#### 1. Food and accommodation

Extremely Satisfied										Extremely Dissatisfied
10	9	8	7	6	5	4	3	2	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

#### 2. The facilitators

Extremely Satisfied										Extremely Dissatisfied
10	9	8	7	6	5	4	3	2	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

#### 3. The programme

Extremely Satisfied										Extremely Dissatisfied
10	9	8	7	6	5	4	3	2	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

#### 4. Value of the week for your leadership skills and network development

High Value										Low Value
10	9	8	7	6	5	4	3	2	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

#### 5. Overall impact of the speakers/provocateurs/mentors

High Impact										Low Impact
10	9	8	7	6	5	4	3	2	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

#### 6. How would you like to be supported during this year in terms of your development and projects?

#### 7. Do you have any other general comments on your experience or the usefulness and impact of the week?

#### 8. Do you have any other general comments on your experience or the usefulness and impact of the week?

Done

## Appendix 15: Feedback from ASLP Participants

### A. Thoughts and statements about the impact of the week captured from video interviews at the end of the week

1. This course was designed really uniquely and quite differently. It gave me an opportunity to develop some of the softer skills that you cannot get from being blasted with lectures. It was a totally new way of approaching instruction and leaderships and trying to bring these skills out practically.  
What I liked the most was the nice mix of speakers on theory of leadership who brought in inspiration and thereafter having the chance to think deeply and discuss deeply with other group members. The perception that we got was not a bookish perception. Ultimately the message we got was shaped by the views and opinions of different people. It was a chance to look at myself and do introspection with regards to a theory from a speaker and what it means to me as a future science leader...It has changed the way I do things, the way I view leadership and the way I engage with fellow colleagues.
2. This is the first program I came across that comes from Africa, for Africans in Africa. It was such a wonderful week. The program, the people, the activities, the goals, how we reach our goals, how we engage, the facilitators, the approach, the method...I have been to over 250 international conferences and meetings and I have never been to such a workshop. I don't think we should even call it a workshop or conference because it's too innovative to be addressed in such a traditional way.  
It has been very productive and free from any social, cultural, intellectual threats. The structure on which the program was based was very innovative... I hope the next meeting is longer. Even though this was longer than the average of three days, we did not get bored or tired, there was something new everyday.
3. I was very satisfied with the week, I was very excited and didn't have a moment of feeling 'why am I here' or 'I want to go home'.  
The experience has been really fantastic...I met with people with whom I connected almost immediately. I always have ideas (about things I want to do beyond my discipline), but I never had the platform to explore, describe and discuss them. This experience allowed me to freely say what I'm thinking and to share ideas about research and science for the benefit of Africa, how to engage communities. These are my interests. This experience has shown me that it is possible and you do have to work with a diverse group of people to achieve it. I definitely learnt and picked up on characteristics about what leadership is.
4. It was an active and engaging week. We were always active and participating in the process. It was an eye-opener on leadership skills and how to engage with people to achieve certain goals.  
The process of learning to come up with our own projects has really impacted me. It was a very engaging, active and fruitful week.
5. I had no doubt that when a group of young scientists get together, the best will be brought out of each and every one of them, and there will be a sense of collaboration and identifying what the issues are. I expected to leave here a better scientist in terms of the way I see things and relate with people and my priorities. I thought the organization of the program would have the traditional form of conferences, but it was different. The aspect of innovation has been wonderful. I have never experienced this kind of approach before. The best was actually brought out of us effortlessly.
6. It was surprising for me how we collapsed challenges to specific areas of problems in Africa and how projects were developed from them. For me this has been wonderful and out of the ordinary. We learnt to think in different directions and that leadership emerges through actions and activities. I really appreciate all that has happened in this ASLP program.
7. I expected to find people of equal intellectual occupations, to be stimulated, to create linkings and collaborations, to find myself within the environment of leadership, to get myself to the right frame of mind to see myself as a science leader and to work with others. I have found that, and more!  
From being part of the program, the way I communicate has changed. The profile surveys have helped me to be more patient working with others and encouraged me to ask how do I see myself. This consciousness has helped me to

appreciate other types of people.

8. I found more than I expected. The facilitators that helped us through the program helped me look at myself differently. They managed to highlight the leadership qualities in me and encouraged me to look back and reflect on where I am currently and how I can use this experience in future.  
This could not have come at a better time for me because of my current position at work. I will use what I have learnt here to influence the people I work with to understand their role in the general population and to initiate collaborations with our African counterparts.  
The vice chancellor of the university said something that resonated with me, that choosing the path of science is also choosing the path of transformative leadership. That really made me think and spoke to me.
9. This is going to change how I do things in future, I expected passive learning and presentations but I experienced active learning where we expressed skills that we didn't know were present. The facilitation was very interesting and I will transfer what I have learnt to my colleagues and students. It has changed my perception as scientist and came at the right time.
10. It was about getting the conversations going and getting the science agenda relevant for Africa on the global agenda and then take it from there.
11. My vision has become much more focused and something I can really put my hands on now. It has really made the future seem more concrete in terms of what I can do, where I can do it and with whom I can do it.
12. Although there wasn't a specific agenda like there are in other conferences, there was an agenda in a way and the process was fascinating, that out of the lack of structure came structure.  
I never viewed myself as a leader to be honest...and one thing that this week emphasized to me is, I am actually a leader, not only in the projects I lead but also with my post-graduate students. Some of the activities I learnt here are things I can do with my students, like turning the problems into questions. I will definitely use what I learnt here very productively.
13. There have been a lot of hands on activities that invokes thinking. I know I am in the right place, I have gained a lot and I feel that the ball has been set in motion.  
The talk from Derek helped me discover a key concept, namely that I can be a leader, and there is a need for me to make a positive shift. I keep reflecting on the video that was played that made me feel 'I can do it' and that there is a need for a change and out of the box thinking.  
My lab is like a mini United Nations. I manage students from everywhere and if I can give the best to them, they are going to influence more people because of their diversity. I am encouraged to put in more effort and to reflect on whether I am producing the right product because they will be the future scientists.
14. My expectations were met; the program was very educating, inspiring and creative and touched on every aspect of leadership and science communication.
15. I am delighted that I have discovered this network of people, who feel as strongly about these issues as I do, so we can start addressing them.  
I have been all over the world and I have not seen as much cultural diversity as I have this week. I did not expect the diversity and the instant connection we had as Africans and the shared heart in thinking about solutions.  
My concept of leadership is intuitive and learnt from mentors. I have not had formal leadership training and was in fact cynical about this as it seemed artificial. This program stood out from other leadership courses with regard to the flexibility and methodology of the creative process. I also learnt how to listen better and other things I hope to take back. My suggestion is to replicate this program across the continent as soon as possible.
16. It has been a very enriching experience; it was so amazing to see how many people were connected with a common and a shared vision of the program and of the projects. I am looking forward to get something tangible out of this project.  
I have never had formal training on leadership and this was a structured program, in a way, but not a traditional leadership program. This has been quite inspiring for me and I am taking back lots of things, especially the tools that I would like to implement into my daily activities.
17. The age group for the program is important because of the gap that exists in Africa in terms age. This program fills that gap and will help in addressing the issues in Africa.
18. This was beyond my expectation. I thought I would be coming here just to design projects, but the way we went about things to develop the project was really fascinating. It was not time or energy consuming, in fact we did it in an exciting way.



19. This program raised very important and burning questions for African science. African science lacks disciplined collaboration on projects and the important to have scholars from different countries. This has always been on my mind. It is also important that this program is amongst young scientists.

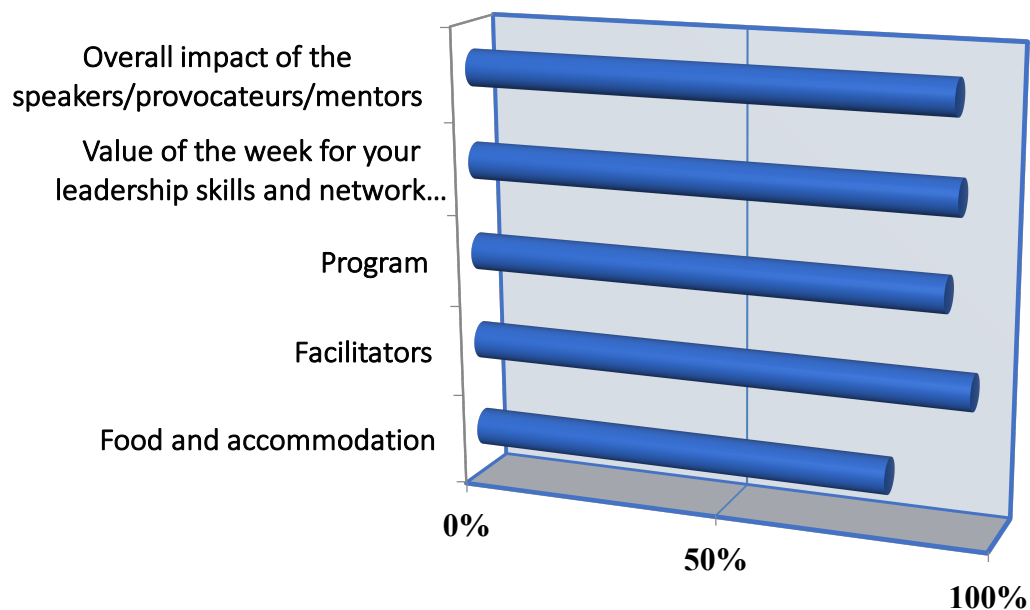
A common thing the speakers emphasized was the power of books and reading. The way the program was organized is amazing; we had some tasks where we had to work together and some alone. This is something I have never experienced and I have been to many conferences.

20. Coming from so far away and in such a different context, I was delighted and encouraged by the warmth that everybody showed towards each other and toward me. It's impressive and inspirational how everybody here is negotiating the diversity of backgrounds and experiences and at the same time identifying something that is unique and common to all of them. I go away feeling extremely inspired.

It reinforced and almost deepened my understanding and feeling of the importance of collective leadership. It's a funny thing that across the world the notions of what leadership is, is very different from how leadership is often practiced. One has to reflect on, who is it in your life that you count as a good leader and how do they lead. Some of the strongest leaders I have seen don't actively lead at all; they enable other people to lead. I feel that my role as a mentor has been exactly that and I hope I was able to do that. The inspiration I come away with is seeing how empowered the fellows are to take up the leadership challenge. Perhaps they have all tried to do this previously and after this week, they have the guidance to go ahead.

#### b. Outcomes of anonymous questionnaire

General feedback was obtained through a SurveyMonkey questionnaire that asked delegates to score their experience from 1-10 on five key criteria.



As part of the survey the fellows could also leave general comments on their experience or the usefulness and impact of the week. Some of the most meaningful are captured below:

It was great! One thing that will remain in my mind forever; do not destroy anyone's idea.....the painting experience.

A role/avenue for interaction should be created for the mentors who supported the application of the ASLP Fellow.

In general the workshop was extremely valuable since it covered several aspects related to leadership in science. It also allowed the interaction with scientists from different parts of Africa. I particularly liked the methods used to generate the projects and the PPCO method used to give feedback. Those are useful tools applicable in my professional life and may have great impact in my work. I think a bit of theory on management tools that might be useful in leadership in science could have contributed to strengthen the quality of the workshop.

It was a wonderful week, great to see many 'bridges' being built during the week; such an impressive group of fellows!

Very well thought and well organized program. Very motivating

It was really worth my while and value adding!

It was a fantastic week, which will complement my work and career.

I had no idea what it would be like or what would be the outcome, but I am delighted to have grown so much in a week, and that I was able to connect with my peers in the continent. I feel like in addition to the information learned from the speakers and mentors we all learned so much about leadership qualities from our peers. I would recommend this program to any person I know who would be interested in developing their leadership skills. I certainly walked away with a much deeper sense of social responsibility and a deeper appreciation of what it means to develop (and utilize) a sphere of influence, rather than confuse it with management, position, structures within organizations, etc. Congratulations should go the selection panel for putting together such a cohesive group, and to the excellent guidance from the Knowinnovation team.

The program was great; and I suggest it should be extended in terms of period and include more other African countries.

## APPENDIX 16: Thematic Analysis of data from the multidisciplinary sandpit

### Ambiguity

*Coming to a place where I knew few people, I didn't know so many people, I didn't know what to expect, because I'm come from a different culture, the structure on which the programme was based was just very innovative and, at some moments, we didn't know where we were going. That created so much passion and enthusiasm and I really wanted to know where are we going? And that kind of guided mystery, because it's not like just mystery, you are just in the jungle and all by yourself, but we were guided, so it's a guided mystery, I would call it, so it made me safe in the unknown.*

Approaching projects with a sense of mystery creates the resilience and intelligence required to flow with the project.

### Communication

*From being part of the programme, the way I communicate has changed. This programme stood out from other leadership courses with regard to the flexibility and methodology of the creative process. I also learnt how to listen better and other things I hope to take back.*

### Context

*I applied to this programme because, I can tell you, this is the very first time in my life that I've applied to (a) programme which is coming purely from Africa, toward Africa, for Africa, in Africa. I mean, I applied to many programmes in Europe, North America, in Asia, in the Middle-East, through different international agencies and institutes but they were all, like, geared toward either North America or Europe, or like, sometimes the Middle-East and most of those programmes were, like, funded by or, like, they were initiated by American institutes, European institutes or Middle-East institutes, so this the very first time that I came across this programme which is coming from Africa for Africans in Africa. I think that's one of the main things.*

Identifying with the context creates a sense of excitement, ownership and engagement at deeper levels

### Discovery

*This experience has shown me that it is possible and you do have to work with a diverse group of people to achieve it. I definitely learnt and picked up on the characteristics of leadership.*

*The process of learning to come up with our own projects has really impacted on me. It was a very engaging, active and fruitful week.*

*The aspect of innovation has been wonderful. I have never experienced this kind of approach before. The best was actually brought out of us effortlessly.*

*It was surprising for me how we collapsed challenges to specific areas of problems in Africa and how projects were developed from them*

*I never viewed myself as a leader to be honest...and one thing that this week emphasised to me is, I am actually a leader, not only in the projects I lead but also with my post-graduate students.*

*The talk by Derek helped me discover a key concept, namely, that I can be a leader, and there is a need for me to make a positive shift. I keep reflecting on the video that was played that made me feel 'I can do it' and that there is a need for a change and out of the box thinking*

*I am delighted that I have discovered this network of people, who feel as strongly about these issues as I do, so we can start addressing them.*

*...to get myself into the right frame of mind to see myself as a science leader and to work with others. I have found that, and more!*

Breaking down the problem into small parts enabled the participants to understand the complexity of the problem and out of that emerged projects of mutual interest. In dealing with emerging projects, leadership from the perspective of confidence in one's abilities to make things happen is key in launching into the uncharted territory of creating ideas.

### Diversity and creative synergy

*What enriched it more was that there was **a nice mix**, where you get people coming in to talk about the theory of leadership not too much, not blasting and blasting but just bringing in those thought provokers, inspiration, and then afterwards you had the chance to really think deeply and discuss deeply with other group members.*

*...so the perception that you got was not necessarily a bookish type of perception but then what you got, ultimately, was a message, which was then **shaped by the views and opinions of different people**.*

*I have been all over the world and I have not seen as much **cultural diversity as I have this week**. I did not expect the diversity and the instant connection we had as Africans and the shared heart in thinking about solutions.*

*I had no doubt that, when a **group of young scientists get together**, the best will be brought out of each and every one of them, and there will be **a sense of collaboration** and identifying what the issues are.*

*The profile surveys helped me to be more patient working with others and encouraged me to ask how I see myself. This consciousness helped me **to appreciate othertypes of people**.*

*I expected **to find people of equal intellectual occupations, to be stimulated, to create linkages and collaborations, to find myself within the environment of leadership**, to get myself into the right frame of mind to see myself as a science leader and to work with others. I have found that, and more!*

*It was so amazing to see how many people were connected with a common and a shared vision of the programme and of the projects. I am looking forward to getting something tangible out of this project*

Diversity and creative synergy open up new frontiers of knowledge creation from a multi-perspective standpoint and, in its highest sense, will inspire creative and interactive thinking among participants.

### **Empowerment**

*This is going to change how I do things in future, I expected passive learning and presentations but I experienced active learning where we expressed skills that we didn't know we had. The facilitation was very interesting and I will transfer what I have learnt to my colleagues and students. It has changed my perception as a scientist and came at the right time.*

*I've always felt that there is a gap, even in my own professional development. I felt that there was a gap with respect with issues to do with science leadership. I have taken some courses, business leadership and some other courses but there was something which was missing, from it and I thought that this programme would help me address to fill that gap.*

*It has really made the future seem more concrete in terms of what I can do, where I can do it and with whom I can do it.*

*Some of the activities I learnt here are things I can do with my students, like turning the problems into questions. I will definitely use what I learnt here very productively.*

*It has been a very enriching experience*

*I think it gave me an opportunity to develop some of the softer skills which you cannot get from that blasting and blasting that we are talking...*

In empowerment, participants both discover and effectively express skills that they did not think they possessed. They were liberated in both their thinking and their creative potential. The future that had appeared uncertain was now full of hope and potential.

## Engagement

*Even though this was longer than the average of three days, we did not get bored or tired, there was something new every day.*

*I was very satisfied with the week, I was very excited and didn't have a moment of feeling 'Why am I here'? or 'I want to go home'.*

*It was an active and engaging week. We were always active and participating in the process. It was an eye-opener on leadership skills and how to engage with people to achieve certain goals.*

*I always have ideas (about things I want to do beyond my discipline), but I never had the platform to explore, describe and discuss them. This experience allowed me to freely say what I'm thinking and to share ideas about research and science for the benefit of Africa, how to engage communities*

*This was beyond my expectation. I thought I would be coming here just to design projects, but the way we went about things to develop the project was really fascinating. It was not time or energy consuming, in fact, we did it in an exciting way.*

Engagement in the project artistry process brings about a heightened sense of self and being in the moment. It is through this engagement that the participants feel in-tune and alive as collective solution designers.

The imagination is triggered to move beyond the present problem into the ideal future and perfect

world. From this future perspective, the participants become the designers and strategists of the future by their devising of bringing their ideal world into today's realities.

## Environment

*It has been very productive and **free from any social, cultural, intellectual threats**. The structure on which the programme was based was very innovative*

It is essential that the environment in which the facilitation takes place fosters a nonjudgemental atmosphere where all the participants feel liberated in their thoughts and in sharing and collaborating on their socio-cultural diversity. Such an environment is created through fluid and adaptable programme structures that inspire innovation.

## Innovation

*The aspect of innovation has been wonderful. I have never experienced this kind of approach before. The best was actually brought out of us effortlessly.*

*I don't even think we should call it a workshop or conference because it's so innovative to be called in such a very traditional way, that's how I look at it. It's been very productive, very..., it's free from any kind of intellectual or social or cultural threats, (and) it was very comfortable.*

*...the structure on which the programme was based was just very innovative and, at some moments, we didn't know where we were going and that created so much passion and enthusiasm and I really wanted to know where are we going?...*

*The approach of the programme was innovative and fluid and this led to productivity.*



The unconventional, innovative nature of the programme ensured that the participants remained both curious and enthusiastic and, therefore, productive.

## Inspiration

*The facilitators that helped us through the programme helped me look at myself differently. They managed to highlight the leadership qualities in me and encouraged me to look back and reflect on where I am currently and how I can use this experience in future.*

*The vice chancellor of the university said something that resonated Improve indigenous housing now, government said, 2007. Available from: <<http://www.architecture.com.au/i-cms?page=10220>>. [8 February 2009]. For me, choosing the path of science is also choosing the path of transformative leadership. That really made me think and spoke to me.*

*This has been quite inspiring for me and I am taking back lots of things, especially the tools that I would like to implement into my daily activities.*

*It's impressive and inspirational how everybody here is negotiating the diversity of backgrounds and experiences and, at the same time, identifying something that is unique and common to all of them. I go away feeling extremely inspired.*

*The inspiration I come away with is seeing how empowered the fellows are to take up the leadership challenge. Perhaps they have all tried to do this previously and, after this week, they have the guidance to go ahead.*

Being inspired allows the participant to internalise the learnings and continue their own journey in the subject. They leave having been exposed to a diversity of backgrounds and experiences of others and, in that, finding a common element that resonates throughout all the participants. This brings the courage that is essential to leadership.

## Learning

***We learnt** to think in different directions and that leadership emerges through actions and activities.*

*I will use what **I have learnt** here to influence the people I work with to understand their role in the general population and to initiate collaborations with our African counterparts.*

*There have been a lot of hands on activities that invoke thinking. I know I am in the right place, **I have gained a lot and I feel that the ball has been set in motion.***

In learning the participants experienced improvements in two dimensions. Firstly, they learnt how to think both laterally and multi-dimensionally and, secondly, via the scientific profiling tools they learnt how to develop their personality intelligence and to use that to foster more effective synergies within their groups and to understand themselves in the context of “others”.

### **Listening**

*This programme stood out from other leadership courses with regard to the flexibility and methodology of the creative process. I also learnt how to listen better and other things I hope to take back.*

In listening, the participants experienced the skill of listening as a rhythmic flow of ideas during which each member of the group had a specific task in the listening process. This enhanced the listener’s communication capabilities.

### **Process**

*The programme was very educating, inspiring and creative and touched on every aspect of leadership and science communication.*

*Although there wasn't a specific agenda like there are in other conferences, there was an agenda in a way and the process was fascinating – that out of the lack of structure came structure.*

*The way the programme was organised is amazing; we had some tasks where we had to work together and some alone. This is something I have never experienced and I have been to many conferences.*

*The way that we have been approaching things before might not necessarily be the best way, so, well, I might have wanted to see more of that blasting but then, coming to think of it, I think that the direction that we took now, for me, I think it was fair.*

*Well, traditionally from the courses which I have attended before, I expected to sit for two hours and be blasted and blasted with lectures, then go for coffee, come back and be blasted and blasted, go for coffee, blasted and be blasted, but then, you know, this course was designed really uniquely and quite differently,*

## Appendix 17: Overall themes relating to personal development from both iterations – ETILAB and ALSP

### *How I see myself now...*

- ❖ *The design thinking process: it opened my mind...,*
- ❖ *It liberated my mind.*
- ❖ *It has changed my whole outlook.*
- ❖ *I have always known I am a creative and that was nice but it was also nice to take my thinking process and actually put into a “bottle”, knowing what I’ve been doing.*
- ❖ *My thinking has definitely changed – the way I look at things, the way I look at problems. That’s the main thing I’ve gotten here and the experience of actually using an app and believing that you can do that in few days and it can be used by other people to solve problems, thank you.*
- ❖ *I came in with preconceived ideas about mobile learning as well as prejudices towards it. I’m leaving knowing that there are possibilities for mobile learning.*
- ❖ *I benefited significantly from the group learning this week and my horizons have broadened tremendously in terms of what may be done in my context with mobile technologies.*
- ❖ *...This course taught me something I hadn’t thought of before.*
- ❖ *I think this has been a nice way to end the course, I mean to end the entire programme because I just get the feeling that we’ve been prepped quite nicely to go out there and save the world hopefully.*
- ❖ *Now, I actually feel that the sky is not the limit because, if we can do in couple of days with the client... what could we do with more time?! I’m looking forward to designing an application.*
- ❖ *I’ve enjoyed this module in such a way that it has changed my way of thinking and I see myself as a problem-solver out there.*
- ❖ *This course has really inspired me to tap into my creative side which I really didn’t think that I had and I think it an amazing way to get me to find solutions and to be creative about the solutions that I find to the challenges that I identify. Normally when I had look at finding solutions it used to be a very boring kind of plotting, a long way without looking*
- ❖ *This is going to change how I do things in future, I expected passive learning and presentations but I experienced active learning where we used skills that we didn’t know we had. The facilitation was very interesting and I will transfer what I have learnt to my colleagues and students. It has changed my perception as a scientist and came at the right time.*
- ❖ *It has really made the future seem more concrete in terms of what I can do, where I can do it and with whom I can do it.*
- ❖ *Some of the activities I learnt here are things I can do with my students, like turning the problems into*

questions. I will definitely use what I learnt here very productively.

- ❖ *It has been a very enriching experience*
- ❖ *I think it gave me an opportunity to develop some of the softer skills which you cannot get from that blasting and blasting that we are talking...*
- ❖ *The aspect of innovation has been wonderful. I have never experienced this kind of approach before. The best was actually brought out of us effortlessly.*
- ❖ *I don't even think we should call it even a workshop or a conference because it was too innovative to be referred to in such a very traditional way. That's how I look at it. It's been very productive, very..., it was free from any kind of intellectual or social or cultural threats, (and) it was very comfortable.*
- ❖ *This has been quite inspiring for me and I am taking back lots of things, especially the tools that I would like to implement in my daily activities.*
- ❖ *It's impressive and inspirational how everybody here negotiated the diversity of backgrounds and experiences and, at the same time, identified something that is unique and common to all of them. I go away feeling extremely inspired.*
- ❖ *The inspiration I come away with is seeing how empowered the fellows are to take up the leadership challenge. Perhaps they have all tried to do this previously but, after this week, they have the guidance to go ahead.*

#### **Comments about teams**

- ❖ *With this module I think it really help so much, I like the comment that we came from different contexts and we really needed to come up with authentic mobile apps for our context as Africans should develop mobile learning apps that are suitable for their context.*
- ❖ *We were searching for a name that encompassed what we wanted to do so we were thinking in the African context of names, for example, like "vula", that means "something", and we looked at Zulu words, we looked at Afrikaans, we looked at English, we came across Swahili and we thought that Swahili would be good. That's how the name for the app came about.*
- ❖ *I thoroughly enjoyed the entire process of working with the client and trying to see what we could do together in order meet to the demands they had and the challenges.*
- ❖ *I benefited significantly from the group learning this week and my horizons have broadened tremendously in terms of what may be done in my context with mobile technologies.*
- ❖ *What enriched it more was that there was a nice mix, where you did not get people coming in to talk about the theory of leadership too much, not blasting and blasting but just bringing in those thought provokers and inspiration, and then, afterwards, you had the chance to really think deeply and discuss deeply with the other group members.*

- ❖ *...so the perception that you got was not necessarily a bookish type of perception but then what you got ultimately was a message which was shaped by the views and opinions of different people.*
- ❖ *I have been all over the world and I have not seen as much cultural diversity as I have this week. I did not expect the diversity and the instant connection we had as Africans and the shared heart in thinking about solutions.*
- ❖ *I had no doubt that when a group of young scientists get together, the best will be brought out of each and every one of them, and there will be a sense of collaboration and identifying what the issues are.*
- ❖ *The profile surveys helped me to be more patient working with others and encouraged me to ask how saw myself. This consciousness has helped me to appreciate other types of people.*
- ❖ *I expected to find people of equal intellectual occupations, to be stimulated, to create linkages and collaborations, to find myself within an environment of leadership, to get myself into the right frame of mind to see myself as a science leader and to work with others. I have found that, and more!*
- ❖ *It was so amazing to see how many people were connected by a common and a shared vision of the programme and of the projects. I am looking forward to getting something tangible out of this project*
- ❖ *It's impressive and inspirational how everybody here was negotiating the diversity of backgrounds and experiences and, at the same time, identifying something that was unique and common to all of them. I go away feeling extremely inspired.*

### Comments about the process

- ❖ *The process was very engaging for all of us while we developed the app for the client*
- ❖ *The design thinking process: it opened my mind..., it liberated my mind. It has changed my whole outlook.*
- ❖ *It was a process, actually, because I think we came up with a 'really cool app' and then a 'cool app' and then, one evening I suddenly thought "Oh, the cool group wanted a 'Scool app'", so "Scool app" evolved.*
- ❖ *I benefited a lot from the theory and practice that we went through and the whole process of thinking and diverging and converging until we came up with a solution, I've also benefitted from so many things, I was able to adapt marketing skills because you had to convince your client to take up something. So it was not only about educational technologies but how you could market your product and how you could understand your client and convince them and produce something they could accept.*
- ❖ *I'm am going to echo a lot of what people said: I really enjoyed the quite excellen mix of theory and practicality that we experienced in this module, I thought Puleng was great and that whole design thinking process, that was very unexpected and, I think, very beneficial.*
- ❖ *It's not only about just finding technological solutions, it's what we learnt, the process of getting to the point and then one starts to apply the technology...*

- ❖ *I'm happy we are not here just to learn, but we've actually lived the experience of learning, I liked the design thinking process and all the activities*
- ❖ *I thoroughly enjoyed the entire process working with the client and trying to see what we could do together in order to meet their demands and the challenges.*
- ❖ *... and the design thinking process, the way that was delivered to us and the practical experience that we had to work through. I think I will take that with me and practise it. I really enjoyed it.*
- ❖ *It's been a very interesting week, Puleng, we've learnt so much about using creative design to create apps for the problem that was given to us by our colleagues.*
- ❖ *I think what was really great about this course was the practicality of it and the actual application, so it wasn't just sitting and listening to somebody, we actually built something and, through the process, we learnt from an experiential perspective which was great.*
- ❖ *I really enjoyed learning about the processes and developing apps, the science behind it and I really did enjoy the practical application of it with the clients, the whole process of presenting to them, getting feedback, making changes and improving.*

#### **Comments related to fun, play or enjoyment**

- ❖ *Awesome course, awesome planning.*
- ❖ *It was very interesting, I enjoyed that very thoroughly.*
- ❖ *Thank you for the passion, it's contagious!*
- ❖ *I can't sum it up better than that it's been really great and I really enjoyed the practical application that we've been learning about in class. I hope that our clients are just as happy as they were early in the class.*
- ❖ *I thoroughly enjoyed the entire process working with the client and trying to see what we can do together in order to meet their demands and the challenges.*
- ❖ *I think I will take that with me and practise it. I really enjoyed it.*
- ❖ *I've enjoyed this module in such a way that it has changed my way of thinking and I see myself as a problem-solver out there.*
- ❖ *It's been a very interesting week Puleng, we've learnt so much about using creative design to create apps for the problem that was given to us by our colleagues.*
- ❖ *I really enjoyed learning about the processes and developing apps, the science behind it and I really did enjoy the practical application of it with the clients, the whole process of presenting to them, getting feedback, making changes and improving.*

#### **Comments reflecting personal transformation**

- ❖ *This is going to change how I do things in future, I expected passive learning and presentations but I experienced active learning where we used skills that we didn't know we had. The facilitation was very interesting and I will transfer what I have learnt to my colleagues and students. It has changed my perception as a scientist and came at the right time.*
- ❖
- ❖ *I've always felt that there is a gap, even in my own professional development. I felt that there was a gap with respect with issues to do with science leadership. I have taken some courses, business leadership and some other courses but there was something which was missing from it and I thought that this programme would help me address to fill that gap.*
- ❖
- ❖ *It has really made the future seem more concrete in terms of what I can do, where I can do it and with whom I can do it.*
- ❖
- ❖ *Some of the activities I carried out here are things I can do with my students, like turning the problems into questions. I will definitely use what I learnt here very productively.*
- ❖ *I think it gave me an opportunity to develop some of the softer skills which you cannot get from that blasting and blasting that we are talking...*
- ❖ *From being part of the programme, the way I communicate has changed*
- ❖ *I never viewed myself as a leader to be honest ... and one thing that this week emphasised to me is, I am actually a leader, not only in the projects I lead but also with my postgraduate students.*
- ❖ *The talk by Derek helped me discover a key concept, namely, that I can be a leader, and there is a need for me to make a positive shift. I keep reflecting on the video that was played that made me feel 'I can do it' and that there is a need for a change and out of the box thinking*
- ❖ *... to get myself into the right frame of mind to see myself as a science leader and to work with others. I have found that, and more!*
- ❖ *There have been a lot of hands on activities that invoked thinking. I know I am in the right place, I have gained a lot and I feel that the ball has been set in motion.*